NO. 19 JUNE 1984 $3.00

THE MAGAZINE FOR ATARI® COMPUTER OWNERS

ANALOG COMPUTING

Telecommunications and the Atari

BATTLE IN THE B-RING (page 35)

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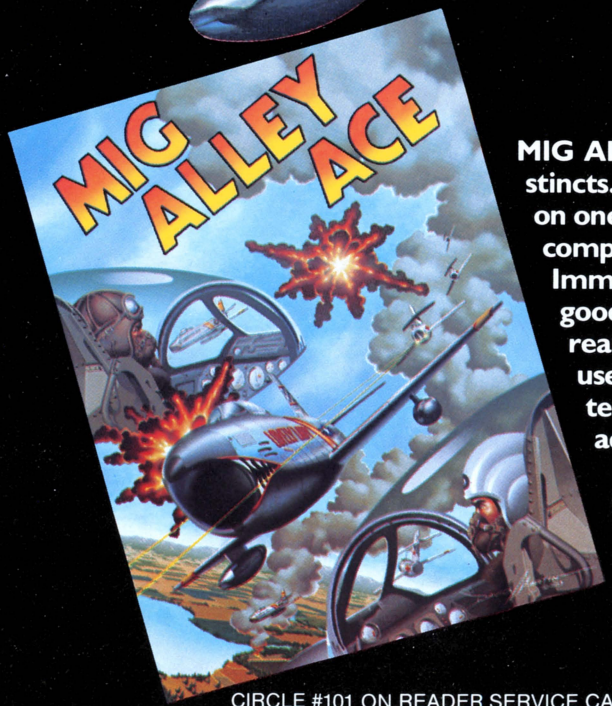

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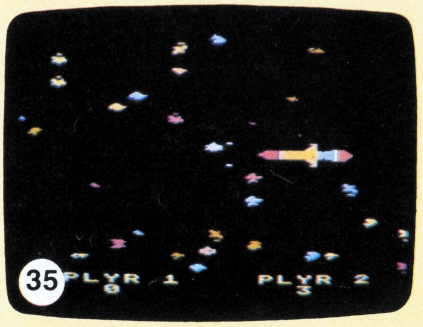

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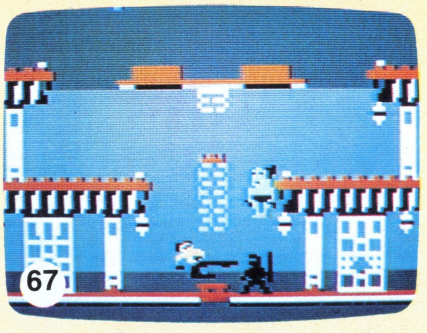

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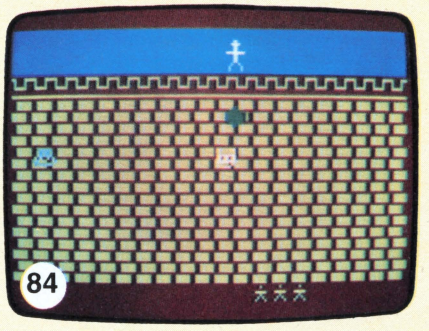

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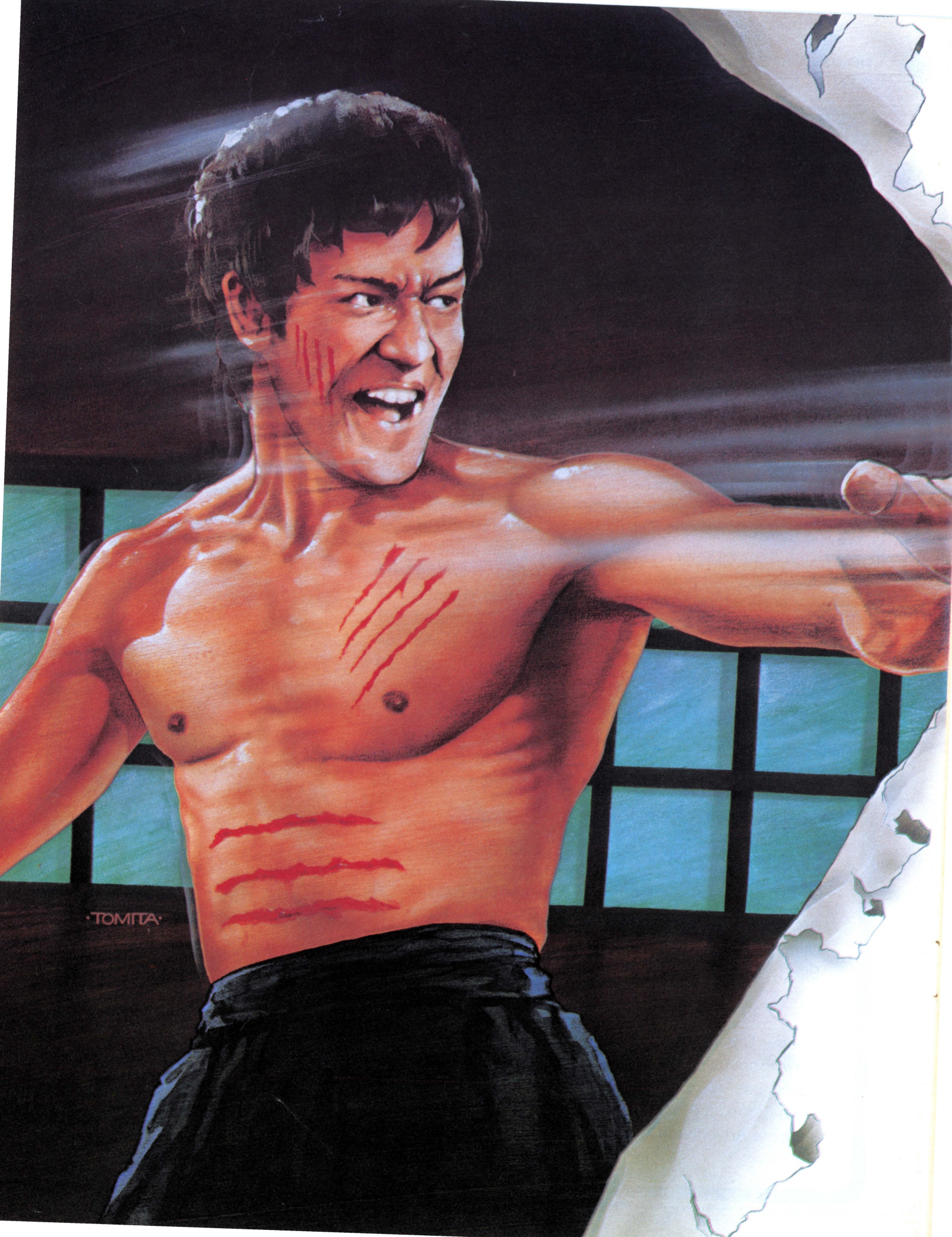
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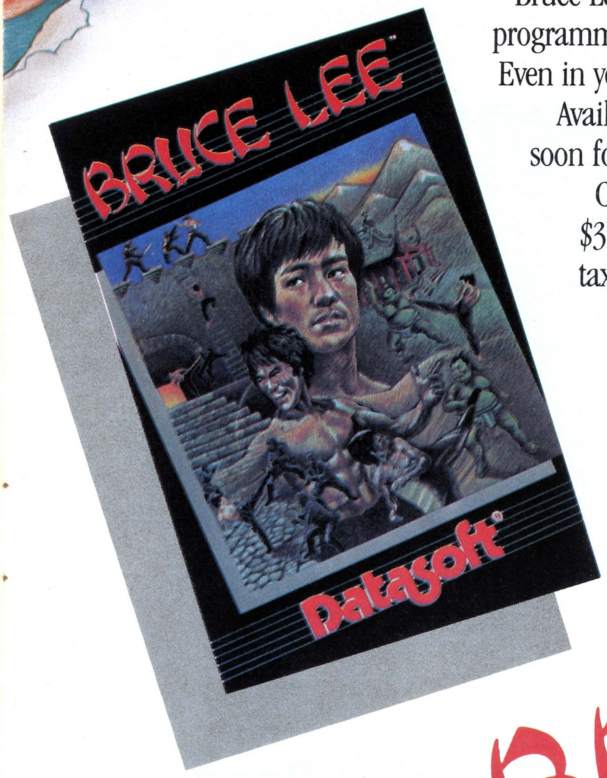

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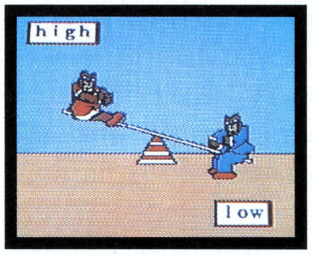

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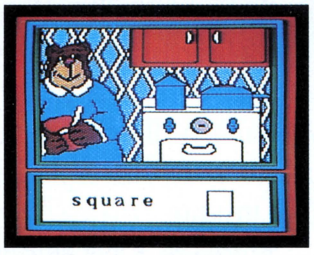

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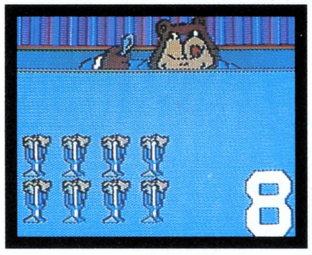

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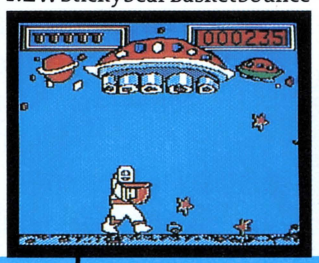
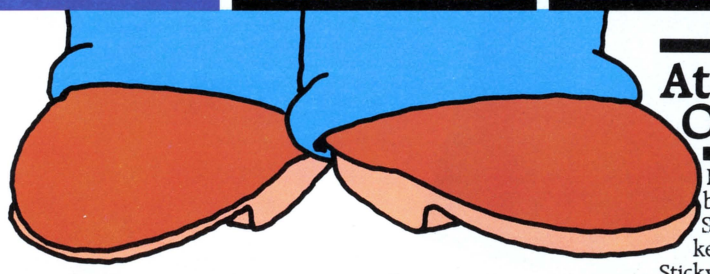


Stickybear Bop



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Why May/June?

No, we're not going bi-monthly. We're just moving the cover date ahead one month — to give us longer newstand exposure. This does not affect the number of issues we publish, nor does it alter the number of issues subscribers will receive.

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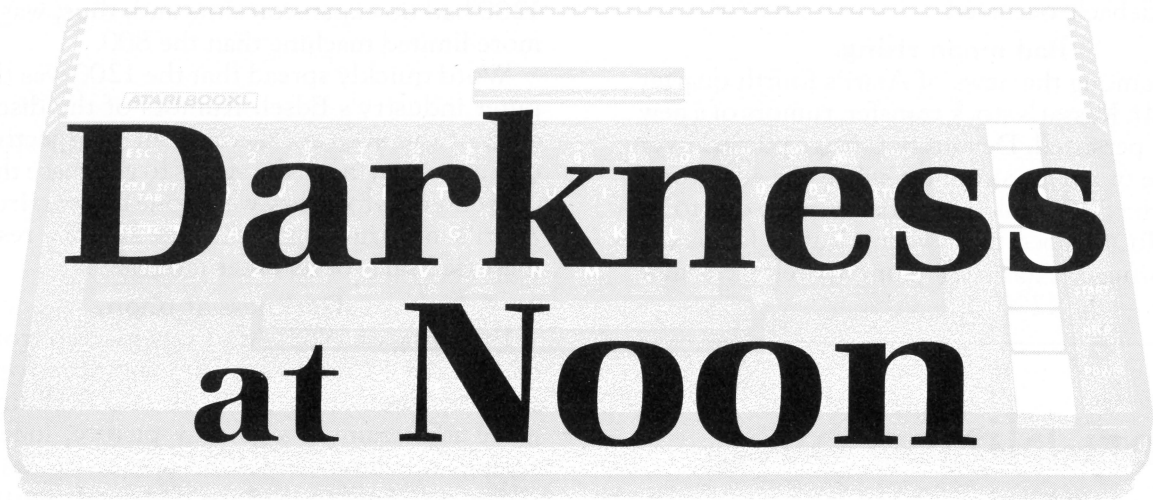

Darkness at Noon

Since the first issue of **ANALOG Computing**, *we have maintained an ambivalent relationship with Atari. Thrilled with Atari's successes, dismayed by its failures, we continue to support Atari computers, but we refuse to pretend that Atari has no problems.* **ANALOG Computing** *has never been a "house organ" for Atari, and we see no conflict between reporting sometimes less-than-appealing news about the Atari world, while continuing to support the best home computers available for under $1,000. Atari's recent past has been bleak, but there are bright rays dawning on the horizon. The following article, composed by several people, is both an editorial and a cautionary tale of corporate mismanagement.*

Only one word adequately describes Atari's rise and fall: *phenomenal*. In 1983 the Atari sun plunged from high noon to a flickering twilight. Atari went from the fastest growing American company to the second biggest corporate loser. (Chrysler was the biggest.) With lightning speed Atari blitzed over ten million American homes, becoming the second most recognized brand name in the United States. Atari...the world became synonymous with innovation, adventure, excitement and success.

And then suddenly, like a solar eclipse, the sky grew dark. In December of 1982 Atari shocked Wall Street and the world by announcing a projected loss for the fourth quarter of 1982. A day before the announcement, Atari chief executive Ray Kassar sold $250,000 worth of Warner stock. But it was only the beginning. Atari executives projected a quick turnaround by the first or second quarter of 1983. It never happened. Although the company still managed to show a profit of 323 million in 1982, it has reported staggering losses of 536 million for the first three quarters of 1983! It is expected to show a loss for the forth quarter of 1983, and current estimates (by new CEO Jim Morgan) indicate that Atari is "not budgeting for profitability" for the first half of 1984. If there is one question that keeps coming to mind, the question is, "What went wrong?"

In a very real sense, Atari has been blinded by its own brilliance. Becoming a 2-billion-dollar company almost overnight, Atari did not have a chance to understand what was happening, and its management team, secure in success, did not attempt understanding. Atari's success came about *in spite of* its management, not because of it.

When the video games began to take off and the money started pouring in, some of Atari's programmers approached Ray Kassar and wanted to discuss the possibility of receiving some royalties for their very successful efforts. They were told that they were no more important than "towel designers" (as reported in the *San Jose Mercury*), and were dismissed with a shrug of the corporate shoulder. In an attempt to show management that it was wrong, some of the programmers left Atari and formed a little upstart company by the name of Activision. Within two years, Activision had captured nearly 30% of Atari's video game market, directly contributing to the 1983 decline.

A combination of upstart video companies fueled by ex-Atarians (Activision, Imagic, etc.) and the tumbling price of home computers contributed to the significant decrease in sales of Atari's video game division and put more pressure on the computer division to "bring home the silicon." By the end of

1983, the Atari computer division saw their market share dwindle from 24% to 12%. A closer look at the division's activities may provide an understanding of how this debacle occurred.

Bad moon rising.

Buried among the news of Atari's fourth quarter loss and Mr. Kassar's stock transfer, rumors of a new computer persisted. Devout 800 users puzzled over the release of a new computer, when the ads promised that the 800 would never be obsolete due to its modular ROM operating system. But in January it became official: Atari was going to release a new computer — the 1200XL.

"Atari blitzed over ten million American homes, becoming the second most recognized brand name in the United States."

Advertised as having 64K RAM, the 1200 featured a sleek new designer look, a redesigned keyboard, and a retail price of $899. Atari advertising called it "the next logical step." Despite its attractive exterior and soft-touch keyboard, the computer was a disaster. Its major flaws were its pricing, new operating system (OS) and "black box" design. At $899 the 1200 was several hundred dollars more than the 800. To justify the increased price, the computer needed to offer some significant improvements over the 800. Instead of improvements, the computer was in reality a step down, a classic example of less for more. The new OS was not completely compatible with software that had been written for the 400/800. Many of the best third-party programs would not run on the 1200. The result was that many people sold their 400 or 800 and "traded up" to the 1200 only to find that some of their most valued software would not work! Even Atari's own **Word Processor** would not run on the 1200.

While not as versatile as the Apple II, the venerable 800 did have the ability to add extra RAM boards, 80-column cards, and other peripherals. The 1200 had no expansion slots and, thus, was a much more limited machine than the 800.

Word quickly spread that the 1200 was the computer industry's Edsel. Rumors of the discontinuance of the 400/800 series sent prospective Atari owners scurrying to the stores to purchase the "old" computers before they were gone forever. Ironically, Atari's introduction of the new 1200XL resulted in increased sales of its older models!

Darkness at noon.

By spring of 1983, Atari was in deep trouble. Its announced 45-million-dollar loss, the universal lack of acceptance of the 1200XL and declining video game sales painted a gloomy picture, indeed. The spring and summer of 1983 witnessed Atari's desperate attempts to turn itself around, starting with massive employee layoffs. [*Editor's note: as of this writing, 600 former Atari employees have charged that they were wrongfully laid off when Atari moved its computer manufacturing facilities to Taiwan. They have filed a class action suit against Atari (but not Warner Communications, Atari's owner) and are demanding back pay.*] Atari was trying to come to grips with the fact that the light of its earlier financial health was growing dim.

In June, at the Consumer Electronic Show, Atari had regrouped its forces and announced its plan of attack. A new series of XL computers were announced, as well as a new group of hardware peripherals. All featured the designer look of the now discontinued 1200. Unlike the 1200, however, the new computers would have an expansion slot and were much more competitively priced. The line consisted of four new XL computers: the 600, 800, 1400 and 1450.

New hardware products were also announced. A new disk drive, modem, expansion box and several printers, all in their designer boxes, comprised what appeared to be positive signs that Atari was "older and wiser" and on the road to recovery.

The trouble was that it was too little and too late. The new computers still used a 1200-style operating system that was incompatible with a significant amount of software. Although the pricing was better ($299) for the 800XL, the XL computer line was really old wine in new wineskins. Nothing exciting or innovative from Atari stimulated the imagination of potential buyers. The new disk drive was an improvement, but was still $200 more than Commodore's, no faster than the old 810, and "featured" a nonstandard "enhanced density" format. Incredible as it may be, the 1030 modem was Atari's third generation of telecommunication packages and it still did not allow uploading or downloading to a disk drive. Although the 1025 printer was devoid of features

(no underlining, superscript, subscript, graphics and very, very slow), it did not require the use of an additional interface. Priced at $250 instead of $550 it would have provided consumers with a functional low-cost printer. Unfortunately, the printer was advertised as being "fast and versatile" and "ideal for word processing."

There were some bright spots in the gathering gloom. The Atari Touch Tablet, the CP/M Module (cancelled, but now reportedly revived, along with the 1450, which should be out by Christmas) and the 1027 Letter Quality Printer were products that were genuinely exciting and competitively priced, but they in themselves did not have the power to disperse the oncoming darkness. Soon after the June CES losses of over $300 million dollars were announced for the second quarter Ray Kassar's resignation was accepted. James Morgan, a Phillip Morris Marketing whiz, was hired as the new CEO. From June on, Atari was in chaos. The huge losses, corporate instability and the bloody Commodore/Texas Instruments price war all contributed to a company that had lost its direction and momentum.

Razor blades or razors?

Unable to hold back the approaching eclipse with its latest hardware offerings, Atari began to look to software for a way out. During mid-1983, Atarisoft was announced. The purpose of Atarisoft was to convert Atari software (games) to other computers, such as IBM, Apple and Commodore.

The creation of Atarisoft set serious Atari watchers thinking. Rumors began to circulate that Atari's market share was so low that it needed to sell software for other computers in order to survive as a company. Others predicted that Atari would become a software-only company. Sideliners speculated that a software-only company could be the end of Atari, because computer software has never been Atari's strong point. 1983 saw little in the way of interesting software from Atari. The two best Atari releases, Atari **Logo** and **AtariWriter**, were jointly developed by third-party developers (LCSI and Datasoft, respectively). Nonetheless the question was posed: could Atari survive its present crisis by switching from razors to razor blades? Unfortunately, the solution to Atari's problems will not arise from dropping its hardware products, nor by having Pac-Man and Pole Position on the Apple and IBM. The problem cuts deeper than "razors or razor blades."

Appliances and kings.

Stephen Ross, Warner's CEO, is reported to have said that Atari's problem is one of marketing. But Atari had no trouble marketing its VCS 2600 system. It had no trouble making Pac-Man a household word. Atari's problem is *management*. A recent article in *West* magazine, reprinted in *InfoWorld*, chronicles the imperial dynasty of the Kassar years. It appears that all of Atari's top managers were kept quite busy playing courtly politics. In a corporate structure where one was never sure of one's status or future, gaining and keeping the emperor's favor took precedence over developing and delivering quality products.

But Atari's managment methods, as bad as they may have been, cannot take all the blame. Atari's problem is that it never understood the computer. The computer is fundamentally different from any kind of product that preceded it. It is a multipurpose device that requires the successful integration of hardware, software, documentation, marketing and sales. Atari has not fully grasped this and perhaps, never will. Almost all of the top management were computer illiterates. They routinely made major software and hardware decisions about a product which they did not understand and *could not use*. To Atari, the home computer was a glorified typewriter or souped-up game machine. It was marketed like a washing machine or stereo.

"Ironically, Atari's introduction of the new 1200XL resulted in increased sales of its older models!"

One of the first rules of successful sales is "Know Your Product." At Apple Computer, there is an Apple on every desk. You would be hard pressed to find a typewriter at Apple. If the corporate execs at Atari took a computer out of the box and tried to do something with it, they might realize that you need more than a glossy four-color brochure with stunning pictures of how to plug in the machine. The documentation of the XL series has been among the worst in the industry. Who else but Atari would start building BASIC into their computers (three years after everyone else) and then include absolutely no documentation whatsoever on how to use the language! Computer illiteracy. How else can one explain the marketing of a printer (the 1025) which was unable to perform any of the functions of the word processor that it was designed to be used with?

Fortunately, there are some pockets of computer literacy in the company. Many middle management personnel use the computer for word processing and financial modeling, as well as recreational programming. Atari Customer Relations boasts of an extremely knowlegeable cadre of technical support people who work feverishly to clean up the messes that their computer illiterate management has made. They provide a toll-free help line as well as a wide variety of supplementary documentation. Without these internal pockets of knowledgeable users, I don't think that Atari could have made it this far.

Electronics for people.

Will the present eclipse be partial or full? Will Atari survive? In some form of a corporate entity; yes. As a major manufacturer of home computers? Some analysts believe that too much has been wrong at Atari for too long for a new fire to be rekindled in its home computer hearth. However, the April 1984 issue of *Computers & Electronics* predicts that sales of home computers will hit $3.6 billion for 1984, with Atari capturing 20% of the market, second only to Commodore. CEO Jim Morgan has given a hint of what might lie ahead when he says that no company has given the consumer a real reason to buy a home computer. Morgan's view of Atari's future is that of a consumer electronics company that makes products people want.

Morgan has indicated that he is interested in producing innovative semi-dedicated microprocessor products that enhance the quality of people's lives. These products are not necessarily keyboard driven or general purpose machines like the current generation of home computers. Morgan seems to have the potential to restore decency and intelligence to Atari's management, and therein lies its hope for sunnier days. Atari seems to have lost the home computer battle but may still win the computer electronics war. Time will tell if Atari can regain the brilliance, innovation, creativity and energy of former years. The current situation makes it almost certain that, if Atari does survive this dark night of its corporate soul, its slogan will be "Electronics for People," not "Computers for People." □

Readers who would like to respond to this editorial, write:

Reader Comment
P.O. Box 23
Worcester, MA 01603

Some program listings reproduced in **A.N.A.L.O.G.** may contain "strange" characters not shown on the ATARI keyboard. These are special characters which use the CTRL, ESC and "ATARI LOGO" (INVERSE) keys. Shown below is a list of these characters and the keystrokes used to get them. □

```
--- CTRL ,
--- CTRL A
--- CTRL B
--- CTRL C
--- CTRL D
--- CTRL E
--- CTRL F
--- CTRL G
--- CTRL H
--- CTRL I
--- CTRL J
--- CTRL K
--- CTRL L
--- CTRL M
--- CTRL N
--- CTRL O
--- CTRL P
--- CTRL Q
--- CTRL R
--- CTRL S
--- CTRL T
--- CTRL U
--- CTRL V
--- CTRL W
--- CTRL X
--- CTRL Y
--- CTRL Z
--- ESC ESC
--- ESC CTRL UP-ARROW
--- ESC CTRL DOWN-ARROW
--- ESC CTRL LEFT-ARROW
--- ESC CTRL RIGHT-ARROW
--- CTRL .
--- CTRL ;
--- ESC SHIFT CLEAR
--- ESC BACK S
--- ESC TAB
--- INVERSE CTRL ,
--- INVERSE CTRL A
--- INVERSE CTRL B
--- INVERSE CTRL C
--- INVERSE CTRL D
--- INVERSE CTRL E
--- INVERSE CTRL F
--- INVERSE CTRL G
--- INVERSE CTRL H
--- INVERSE CTRL I
--- INVERSE CTRL J
--- INVERSE CTRL K
--- INVERSE CTRL L
--- INVERSE CTRL M
--- INVERSE CTRL N
--- INVERSE CTRL O
--- INVERSE CTRL P
--- INVERSE CTRL Q
--- INVERSE CTRL R
--- INVERSE CTRL S
--- INVERSE CTRL T
--- INVERSE CTRL U
--- INVERSE CTRL V
--- INVERSE CTRL W
--- INVERSE CTRL X
--- INVERSE CTRL Y
--- INVERSE CTRL Z
--- ESC DELETE
--- ESC INSERT
--- ESC CTRL TAB (CLR)
--- ESC SHIFT TAB (SET)
--- INVERSE SPACE
--- INVERSE _
--- INVERSE CTRL .
--- INVERSE CTRL ;
--- INVERSE |
--- ESC CTRL 2
--- ESC CTRL BACK S
--- ESC CTRL INSERT
```

READER COMMENT

Dollars and Cents in Atari BASIC

Like most versions of BASIC, Atari BASIC does not print zero values. If you work with dollar values and the cent value is zero, BASIC does not print the decimal point and the zero cent value. For example, $25.00 will be printed $25, and this would look rather strange.

The following one-line routine will overcome this problem for dollar amounts with up to three zero decimals. The result always shows two zero decimals. For example, if the program has computed the following values for the numeric variable X, the converted result in a string, V$, always shows two zero decimals.

Example:

```
X=25.000
X=25.00
X=25.0
X=25
```

Result always V$ = $25.000
Here is the one-line routine which solves this above problem:

```
V$=STR$(X+.006):V=LEN(V$):
V$=V$(1,V-1)
```

This routine also takes care of rounding in case of three decimals, i.e.:

```
X=25.001 --> V$="25.00"
X=25.005 --> V$="25.01"
X=25.008 --> V$="25.01"
```

Sincerely,
Fred Jansen
Winnipeg, Canada

Dear **ANALOG**,

I've been wondering for a long time if there is any way to "kill" the SYSTEM RESET key. I know that POKE 590,1 will disable the key, but it will also get rid of the program when pressed. I hope that you will tell me the answer to this as it is very important to me. Also, if you don't have a printer to make a copy of the program, can you still submit articles and programs to **ANALOG**?

Thanks for your attention.
Greg Taunt
Springfield, MO

1. There is no way to disable the SYSTEM RESET key, unless you physically disconnect the keyswitch.

2. We prefer that submitted articles include printed program listings, but if this is not possible, we will accept submissions with programs on cassette or disk only.

—TH

I recently wrote to the attention of Bert Williams and Tom Hamel about some trouble I was having with their disk cataloging utility in issue 11. I am using a 48K 800 with a Percom double density drive and OS/A+ or ATARI DOS 2.0. The program as I typed it CHECKed perfectly, but when RUN would apparently hit an ERROR when it tried to read a disk directory. Now remember, I just purchased the disk drive and am trying to learn how to use the DOS's.

Well, to make a long story fairly short, after I sent off that letter, I read up as much as I could on drives and operating systems. Then, after another attempt at debugging, I realized that the problem was two-fold:

1) The routine to read the directory, being booted in double density, would see garbled material when it tried to read it from an ATARI DOS single density disk.

2) The part that formatted the DATA lines from the directory was set up for the display of an ATARI DOS disk directory and printed meaningless information to the DATA lines when reading the different display format of the OS/A+ directory.

The remedy was simple, now that the discrepancy was obvious. All I had to do to use the catalog utility on an ATARI DOS formatted disk was to boot the program in that format. Then all I had to do for the OS/A+ was to rewrite the lines printing the DATA lines for FILENAME.LST.

These changes are outlined here:

The DIM statements in Line 70 must be changed to handle the wider directory display of OS/A+:

```
70 DIM FILE$(Q3+Q34),C$(Q3
+Q34),FA$(Q3+Q34)
```

Change the "end of directory" search in Line 420 to:

```
420 INPUT #Q1,FA$:IF FA$(Q
7,Q10)="FREE" THEN ? C;",
";FA$(Q3,Q34);",0":GOTO Q43
*Q10+Q30
```

The FOR-NEXT loop in Line 425 must be changed to:

```
425 ? C;",";:FOR I=Q3 TO Q
34:IF FA$(I,I)=" " THEN ?
FA$(I,I);:NEXT I
```

Then delete Lines 430 and 435, and change 440 to read:

```
440 ? ",";FA$(Q1+Q34,37);
```

And that's all there is to it! It's amazing what you can learn if you try! So now I have two catalog disks—one for those formatted in double density and one single density.

See you later,
Patrick Stewart
Reno, NV

Dear Sirs,

This is the first time that I had seen your magazine locally and bought it (#17). I am wondering why, in your "DISK MISER" article, did you use two types of BASIC? **Listing 1** is in regular Atari BASIC, and **Listing 2** is in Microsoft BASIC. For people who only have Atari BASIC, like myself, it makes it a little hard to use your programs. Thanks.

Sincerely,
V.L. Burton
Great Falls, MT

"Disk Miser" runs fine in Atari BASIC. **Listing 2** *of the article is not Microsoft BASIC, but the assembly language source code for the DATA in lines 600-610 of* **Listing 1**. *You don't need to type* **Listing 2** *to use the program; it's provided so that advanced programmers can see how the program operates.*

—TH

Dear **ANALOG**,

I have become reasonably fluent in Atari BASIC, jazzing it up with machine language as I am able to, and compiling it with ABC (compiler). I'm pleased with this approach, but I can see that machine language programmers are able to do things that can never be done directly through BASIC. So I took on the formidable task of learning 6502 machine language. Then, as your magazine has hinted at in past issues and I have heard from other sources, Atari comes out with a new advanced computer with, let's say, a 32-bit processor. My question to you is: how useful would knowledge of the 6502 be in those circumstances?

Sincerely,
Walt Huber
Atwater, CA

An important thing to remember about programming is that effort spent learning another language is NEVER wasted. Most ANALOG programmers knew 8080 assembly language, and when the Atari computers showed up, we picked up 6502 assembly relatively quickly.

In the event that Atari moves up to a 16-bit processor, knowledge of the 6502 will only help you learn the new chip faster. Sure, there'll be differences, but there will also be a lot of similarities.

—TH

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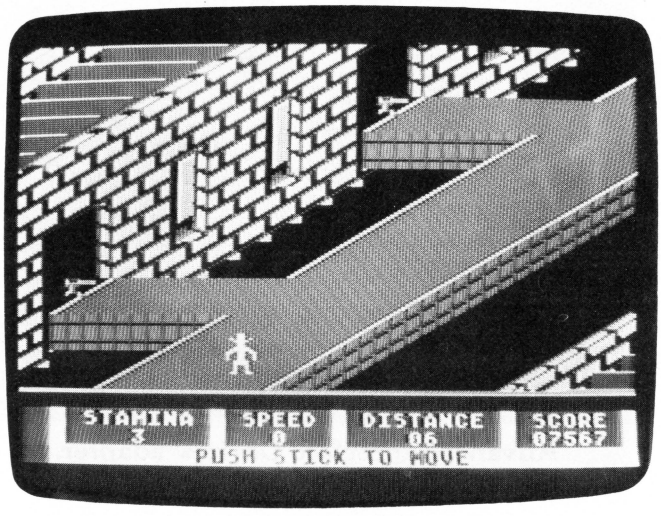
NEW PRODUCTS

by Lee Pappas

As we enter spring, we find many new and varied software *and* hardware products hitting dealer shelves. **Dimension X**, the long-awaited game from SYNAPSE, is similar to several **Battlezone**-type programs on the market (including SYNAPSE's own **Encounter**). Although **Dimension X**'s graphics are somewhat flashier than those of **Encounter**, the gameplay isn't very innovative and probably won't hold your interest too long. The only outstanding feature of the game is the scroll-in-any-direction moire pattern landscape. When you're not flying over the ground zapping Rigillians, you're flying through tunnels connecting more enemy sectors. Navigating these tunnels consists of centering a cursor between two moving vertical planes and avoiding horizontal "gate" lines. This part of the game, unfortunately, doesn't live up to the promise of the landscape graphics. (For a further review of **Dimension X**, see page 88.)

Fortunately, SYNAPSE rebounds with **Relax**, the most innovative and controversial piece of Atari software to be released so far this year. Comprised of both hardware and software, **Relax** uses bio-sensory techniques, allowing you to monitor your own stress levels. I had a chance to experience **Relax** first-hand, and found it quite fascinating and not at all "gimmicky." A headband containing sensors registers the wearer's muscle tension. With the aid of several programs included in the **Relax** package, you may display an analytical scrolling graph, a colorful kaleidoscope display, or a game where you must control the path of a balloon floating over obstacles. A workbook and audio cassette are also included.

Relax.



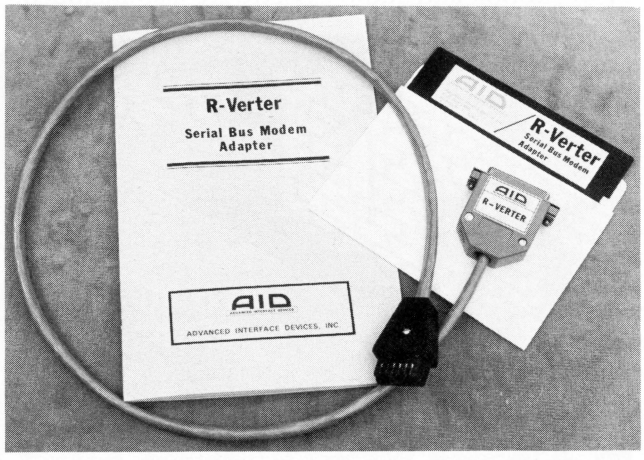
Space Cowboy.

Space Cowboy is a new game from AVALON HILL. As the title character, you must escape from imprisonment on the feudal planet Dungeon and make your way back to your spaceship. You must traverse a three-quarter view 3-D landscape, not unlike BRAM's **Zombies** or the landscape in **Zaxxon**. Your escape is made difficult by oil slicks, pitfalls and robot lasers.

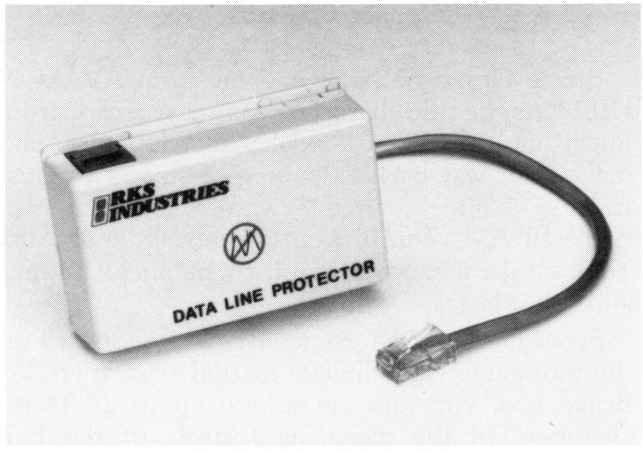
From DATASOFT comes **Bruce Lee**, based on the film exploits of the late martial arts expert. As Bruce Lee, you must penetrate up to 20 secret chambers of the menacing fortress of the Evil Wizard, capturing treasure along the way. In your journey through the fortress, you must fight the forces of the deadly Ninja, the massive Sumo wrestler Yamo and the magic of the Evil Wizard. Suggested retail price for the game is $34.95. DATASOFT is also releasing **The Dallas Quest**, based on the hit nighttime soap opera; **Nibbler**, a translation of Rock-Ola's arcade game; the educational program **Heathcliff**, based on the syndicated

cartoon character; **Letter Wizard**, a follow-up to DATASOFT's earlier word processing programs; the survival games **Genesis** and **Lost Tomb**, the latter based on STERN ELECTRONIC's arcade game.

MICROBITS has released a 64K memory module for the 600XL computer (see review on page 28.) They also have **MicroFiler**, a file management program for $49.95 that has user-adjusted screens and cassette/disk storage capability. RKS INDUSTRIES' new filter protects your modem and equipment against surges over communication lines. And ADVANCED INTERFACE DEVICES has a serial bus modem adapter for the 400/800, 600XL/800XL lines. This unit permits most modems and RS-232 devices to be used on the Atari without the 850 interface module. The cost is $49.95.



Advanced Interface Devices' adapter.



RKS Industries' filter.

FIDELITY INVESTMENTS of Boston has announced a computer-based home brokerage trading service. This allows customers, on a 24-hour basis, to enter buy and sell orders on posted and OTC stocks and options. Investors can also receive quotes, updates, and review their tax records. FI can be reached at (617) 292-7040.

ADVANCED FINANCIAL PLANNING offers an Atari compatible program, **Life Insurance Planning**, capable of calculating inflation rates, the user's total estate needs (including future expenses), and other factors (Social Security, outside sources, etc.), after all data has been input into the computer. The program requires 32K and costs $29.95. When purchased with the company's **Retirement Planning** programs, the total cost drops to $49.95.

Stomper and **C'est La Vie** are two new products ADVENTURE INTERNATIONAL touts as innovative arcade games. In the latter, you play a character who picks up money off the streets, attempting to build a fortune. His pursuers include loan sharks, tax collectors, and criminals. Players may invest the money in banks and the stock market (the next best thing to the Massachusetts Megabucks jackpot). **Stompers** pits you against pests at a picnic-outing.

AI is also releasing #13 in their adventure series, **Sorcerer of Claymorgue Castle**. Aimed at the experienced adventurer, the scenario is that of a medieval magic theme. XLENT SOFTWARE now has **Mode Mixer**, a display list altering programs, and **Battle Stations**, a war game.

COLLECTOR'S DATA SERVICE provides a huge gallery for those interested in nearly any topic: stamps, cars, yachts and travel represent only a small fraction of what this system could support for the serious collector. Hundreds of local phone numbers put you in touch without toll calls. For more information call (206) 281-7273.

Two programs from HOME COMPUTER SOFTWARE are **Plaqueman** and **Kids Say the Darndest Things . . . to Computers**. The latter, based on Art Linkletter's "KIDS SAY" books, centers around creating and telling stories. □

HAYES SMARTMODEM 1200
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by Tony Messina

I have received many calls and letters over the past several months inquiring into my whereabouts (or lack thereof) in the pages of **ANALOG Computing**. You see, friends, I have been heavily involved with substances, materials and other items which have reduced my brain to what looks like a blob of smouldering jello. No, it's not what you think. Actually, I have been locked away in a lab for the past six months, tasked with interfacing a variety of computers via a telecommunications link. I have been successful, and the task is done.

What does this have to do with my review? Well, the piece of hardware which made my task much easier than anticipated was **The Hayes Smartmodem 1200**. Those of you who have not read Charles Bachand's article on modems elsewhere in this issue should read it before proceeding. If you already know what a modem is and how it works, then let's talk about the **Hayes Smartmodem 1200**.

What's a Smartmodem 1200?

The **Hayes Smartmodem 1200** (I'll refer to it as HS1200 from this point on) allows your computer to access the outside world via the telephone lines. So what, you say, that's what they all do! Correct, but the HS1200 is one heck of a souped-up way to do it. Many modems allow operation at 300 baud, while others allow 1200 baud. The HS1200 allows both and is restricted only by the baud rate of the device with which you are communicating. In addition the HS1200 is very "smart," hence its name.

How smart is it?

I'll address the above question by first describing what is behind the intelligence of this modem. The HS1200 has an internal Z8 (not Z80) microprocessor. Along with this, the real "brains" behind the operation is a 4K ROM controller program. What does this 4K ROM allow you to do? The program allows the modem to communicate with either you or the computer. This modem can be given commands and will answer you with either English replies or numbers. There are too many commands to discuss, but the most important commands are:

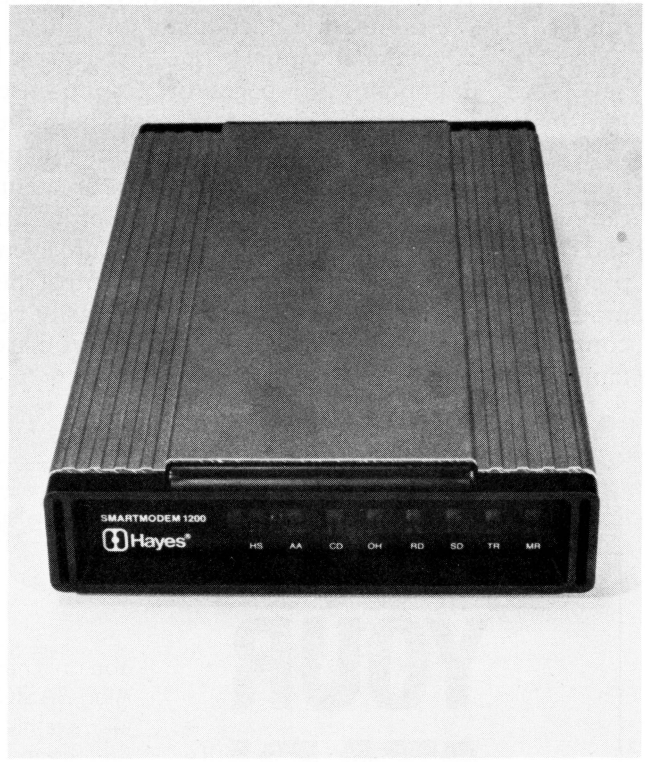
1) A — > Answer the phone.

2) A/ — > Repeat the last command given (it remembers).

3) D(TP) — > Dial the phone (touch or pulse dial).

4) H — > hang up the phone.

This is a very brief list, but it gives you an idea of the capabilities the modem has. The commands usually have parameters which are sent along with the command. For example, to dial a phone number one would send the modem AT (attention modem) DT 1-401-845-7742 (Dial the number — touch-tone dialing 1-401-845-7742). Without the explanation, the command would be ATDT 1-401-845-7742. Upon receipt the modem would "pick up the phone" and dial the number listed. Actually, with this modem you do not need a telephone at all! Everything is built inside the unit. The wire coming out of the wall connects directly to the modem.



The Hayes Smartmodem 1200.

There are actually two states that the modem can be in. COMMAND state allows you to send commands to the modem (nothing goes across the telephone lines). ON-LINE state is automatically entered when the modem detects a carrier signal and hooks into the remote computer, or when the modem answers the telephone and then allows another computer to hook into it. You may have noticed that I said that the modem answers the phone. This is another feature commonly called AUTO-ANSWER. The modem can be programmed to answer the phone on the number of rings specified (1-255). This can be useful for running a bulletin board, having your computer waiting for you to call from a remote location or zapping a crank caller with a

(Continued next page.)

carrier signal they don't expect. One question which probably comes to mind: If I don't need a phone with the modem, how do I know what is occurring on the line when I dial a BBS or remote computer? The modem is equipped with an internal speaker and allows you to monitor the call. The modem does not have a microphone, so you cannot talk to anyone while it is connected.

Documentation.

Although I have been rambling on about how smart the HS1200 is, there are a few items I forgot to mention. You must write the programs to control it or to send it commands, if you want to control it automatically. Don't be frightened away, because this is where we discuss the documentation.

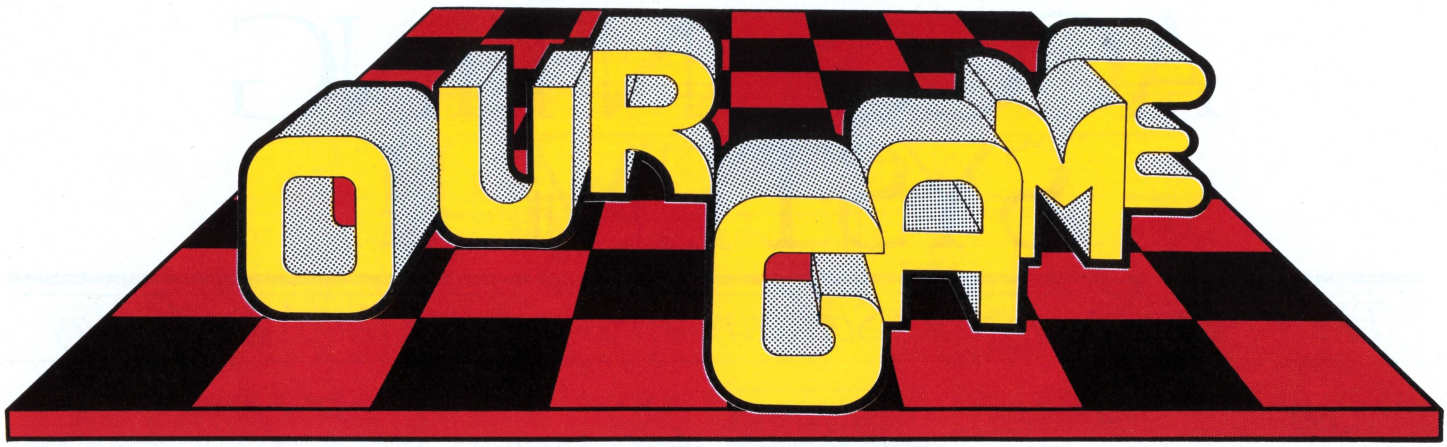
The HS1200 owner's manual is one of the nicest I have seen. It contains 48 pages of no-nonsense information, along with eight appendices to help you with anything from RS-232 Pin assignments to hooking up the modem for use with an amateur radio. Everything you need to know about setting up and operating the modem is in here. There are even pseudo-programs to show you how to do control the modem from your computer. These can easily be converted to BASIC, or whatever language you are familiar with.

Many companies sell you a product and then leave you on your own. Not so with Hayes. Any problems will be handled in a professional and timely manner via their customer service line.

Is this for you?

I did want to mention that this modem may not be for you. You may have noticed that the list price is a bit overwhelming. Careful shopping can yield prices between $400-$500. Those of you who only intend to telecommunicate on an occasional basis may not find use for many of the modem's features. If you plan on running a bulletin board or want to take advantage of the many fine programs available which specifically support the HS1200, then it is definitely worth your while.

The HS1200 is considered the ultimate in high speed, affordable modems. I can personally vouch for the reliability of the HS1200. Within our organization we have three HS1200's. All of them have been running twelve hours a day, five days a week for the past two and a half years. One malfunction occurred which caused the modem to be shipped back to Hayes. The modem was returned within three days and is back on-line. Considering the alternatives, I would not want to sacrifice this kind of reliability and service in order to save a few dollars. □



by Joel Gluck

Yow! Vacation's over, and it's time for **Our Game**, the only column in which you, the reader, get to influence the course of history! Yes, merely by sending in your ideas, criticisms, and comments, you can have your say as to what "our game" (the game we are writing together) will be like! In fact, if you send in some really interesting thoughts, they may well be printed in these very pages!

Enough hype. Let's get down to the nitty-gritty. Last time I promised that we would soon start the development of "our game" itself. Well, I haven't broken my promise. Read on and you'll see how to participate in *Our Game's Special Election Year Game Idea Vote!* But before we get on to this new business, let's first take care of some old business...

Reader mail!

What would **Our Game** be without reader mail? Not very exciting, for starters. It's no fun to hear only one point of view (specifically, mine). But, thanks to a few brave souls who had the courage to take the dreaded leap off the eyebrows of anonymity, and into the far-seeing and all-encompassing Atarian public eye, the great tradition of reader mail goes on! (If you found that last metaphor a bit overdone, call the Ridiculous Metaphor Hotline at 1-800-555-1234).

Allen Harberg of Glastonbury, Connecticut, writes: *"Here's a game for the entire family: Diaper Panic. Two doting grandparents rush to return an infant to its parents before time runs out."*

Thanks, Allen, for your, uh, game idea...

Larry Friemel, of Fullerton, California, has a gripe for the software industry:

"I feel time and care must be spent on writing software-embedded instructions and accompanying documentation. It should be of a quality that anyone reading it can understand and can feel satisfied that they have control over their program. Most software documentation today is like Chinese food, i.e., you may feel satisfied at first, but as you get deeper into it you find it says less and less, leaving your appetite unsatisfied — often to the point of frustration. You get the feeling that, just maybe, someone spent a whole day describing a piece of software which took months to create, refine and make marketable. We should deplore such works which are written as adventure games, leaving it up to the user to hunt for clues about how to use them."

I agree with your views on documentation, Larry, although I do feel that the situation is improving, and that most software companies today spend quite a bit of effort and money on good documentation. As for **Our Game**; a discussion of the ingredients of good documentation is in the works — and "our game" itself will certainly have decent internal and external documentation.

In general, the question of documentation will become less important as systems become easier and friendlier to use. Apple's Macintosh is an excellent example of this: its operating environment is extremely friendly and does not hide features, making documentation practically unnecessary. (Of

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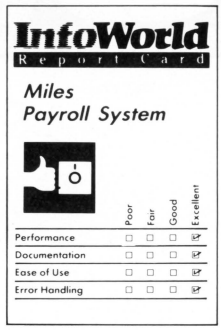

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course, Apple does supply excellent documentation with the Mac.)

And one more thing, Larry: I don't appreciate the comparison of poor documentation to Chinese food. Aside from sleeping and listening to music, Chinese food is one of the chief pleasures of life. Please keep your analogies to yourself.

Jason Leigh, of Kowloon, Hong Kong, sent me a letter (by air mail) with the most gorgeous stamp I've received since **Our Game** began. It's a 30-cent stamp called "Hong Kong by Night." Jason's game idea isn't bad either. He writes:

"Why always be the good guys? You could have a game where you hold up a bank. The first level begins as you have to plant sticks of dynamite on the vault, while shooting bank tellers trying to get to the alarm bell. Every time you shoot a teller, he returns to his counter and his sequence of migrations to the bell re-starts. When you've attached enough dynamite to the vault, it blows up and you can rush inside to grab a bar of gold. You can carry one bar at a time and you must carry it back to your get-away car each time. When you have your hands full you cannot shoot, so there is a danger of the bank teller's reaching the alarm bell. When your attempt is successful, your computer figure grins happily out of the screen and you begin robbing the next bank until you're eventually caught."

Sounds like you've got the makings of a coin-op game hit, Jason: action, violence, skill, and suspense (when the alarm bell goes off, it's risky to stay because the police will show up; on the other hand, there's more gold to be had in the vault).

David Plotkin, of Walnut Creek, California, makes several intelligent points in his letter:

*"You made the statement that the game will be written in BASIC, and ruled out machine language and BASIC Compilers for worthwhile reasons. But what about machine language subroutines, either on the Vertical Blank or called via USR calls? You don't need to know machine language to include these; many very good ones are available "canned" — you just include the DATA statements in your program and call the routines as needed. These routines have tremendous potential to increase the number of "moving objects" from one to four or five, especially if VBI routines for Player/Missile objects are used. Another excellent routine which comes to mind is Tom Hudson's "Graphic Violence," (***ANALOG Computing** *no. 8) which puts multiple animated explosions on the screen. Too long? How about the flickering starfield on the Display List Interrupt provided by Joe Trem in* **ANALOG** *no. 6. Or background music on the VBI provided by Mark Chasin in* **ANALOG** *no 7.*

WHAT IS D:CHECK/C:CHECK?

Most program listings in **ANALOG** are followed by a table of numbers appearing as DATA statements, called "CHECKSUM DATA." These numbers are to be used in conjunction with D:CHECK and C:CHECK, which appeared in the **ANALOG Compendium** and Issue No. 16.

D:CHECK and C:CHECK are programs by Istvan Mohos and Tom Hudson. They are designed to find and correct typing errors when entering programs from the magazine. For those readers who do not have a copy of either article, send a pre-addressed, stamped, business-sized envelope to:

D:CHECK ARTICLE
P.O. BOX 23
WORCESTER, MA 01603

*Tom Hudson's Player and Missile mover routines (**ANALOG Computing** no.'s 10 and 11) are excellent. The list goes on — scrolling, character movement, etc. The point is that these routines already exist; all we have to do is include them...*

"Finally, you made a comment in your January column which is not strictly true. You said that BASIC doesn't let you use names for procedures, and that instead you have to use line numbers. What you can do, since you can call named *subroutines, is equate your line numbers to a name, giving you something like this:*

```
900 PREPARETUB=2000:CATCHROVER=3000:RO
VERINTUB=4000:CLEANROVER=5000:DRYROVER
=6000:THANKROVER=7000
1200 GOSUB PREPARETUB
1210 GOSUB CATCHROVER
1220 GOSUB ROVERINTUB
1230 GOSUB CLEANROVER
1240 GOSUB DRYROVER
1250 GOSUB THANKROVER
```

"Pretty descriptive, no? Unfortunately, the disadvantage to this system is that it's hard to trace the program logic, because you keep forgetting what names are equated to which line number. Oh, well."

Other readers have mentioned the idea of incorporating machine language subroutines into our game, David, but none have seemed as well-versed on the subject as you. My own opinion on using machine language subroutines for our game is this: we will use them only if they are necessary to make our game enjoyable.

If it sounds like I'm hesitant to plan on using such a subroutine in **Our Game**, you are correct; I would prefer it if our game were written in such a style as to make its operation clear to all readers, even those with an elementary understanding of Atari computers and BASIC. All too often, machine language subroutines are complex black boxes — which is fine if your sole aim is to improve a program's performance. **Our Game**'s purpose, however, is not to produce the best possible game but rather to produce a good game in a manner understandable and reproducible by novices.

As for your point about named subroutines — you are absolutely right; I had neglected that possibility. There is another disadvantage, however, to your named-line-number scheme: the program cannot be renumbered by a standard line-renumbering program, because the values of the names wouldn't be changed.

That's it for reader mail this month (except for some special mail — read on!). For those of you who have sent mail and haven't seen it in these pages, please be assured that I read every word that you send me; it's just that I can't possibly include all of it — at least not if **ANALOG** is going to have room for anything else! Don't be discouraged — all of your ideas and comments help shape the content of this column. Keep those letters coming!

The Ultimate Wimp-Out.

As sole author of **Our Game** (the column, not the game), I believed, until recently, that it was up to me to choose which idea, among all of your ideas, would be the basis for "our game."

But then I had a horrible thought. What if, after deliberating over various game ideas, choosing one, and presenting it in the column...*what if* the readers didn't like it? The dreadful consequences aren't difficult to predict: reader interest would decline, I would receive fewer and fewer letters, and **Our Game** would bite the dust.

But, just in the nick of time, I came up with a solution: **The Ultimate Wimp-Out**. You guessed it! I won't decide! You'll decide! You (the readers) will vote on it!

Yes, this column marks the commencement of the soon-to-be-forgotten *Our Game Special Edition Year Game Idea Vote*. To participate, all you have to do is send in a letter or postcard with your vote for best game idea (of the four described below) and a simple suggestion for the improvement or embellishment of that game. All votes must be in by August 1, 1984. Void where prohibited by law. The decision of the judges (me) will be final.

Now that we've gotten the rules out of the way, let's proceed to our four beautiful nominees:

It's Number One!

Game Idea #1 comes to us all the way from sunny Milton Keynes, England. Trevor Skeggs (I love that name!) writes:

"Please don't mention that they're also struck down with Atari Fever in little ol' England (sorry, Trevor), *but, if you must, my shoe size is 9, and I doubt if you've heard of my brand of toothpaste (comments directed at the January issue).*

"I agree that violence is definitely 'passe' in video games, but it's awfully hard to substitute for the excitement of trying to hit something.

"Therefore, in my game's scenario, the player is seated in a rowing boat on a lake. Opposite him is his huge wife, and in his hands is a black box (camera).

"The object is to prove that the Loch Ness Monster (Nessie) exists by taking a photo. Under the boat swims a dark, ill-defined shape, which occasionally breaks surface with a long-neck and insidious smile, played for laughs.

"The joystick controls the man's arms as you quickly spin round and take a picture. The top corner of the screen shows the developed photograph, which more often than not shows a foot, his wife's ugly face, a dead fish, a tin can, etc."

If you liked Trevor's idea, write a big number one on a piece of paper (so that Victor, our Robot Vote-Counter, won't misread it), along with your thoughts about how the game could be made even better, and mail it to **Our Game**!

Numero Dos

Game Idea #2 is a combination of several reader's ideas. Charles D. Ybarra of Long Beach, California, mentioned in a letter that a game about food and nutrition would be interesting. Several readers recommended the idea of a computer board-game, including Del Rice, of West Pittsburg, Pennsylvania (who sent me an hilarious letter explaining why nobody reads **Our Game**), and Eric Hansotte of Glenshaw, Penn., as well as George Lentz of Toms River, New Jersey, who writes:

"Video games are based mostly on skill with little or no luck involved. If you don't have good hand-eye coordination you can pack it in for most of today's video games! If ***Our Game*** *used a graphic roll of the dice or spin of the wheel, I feel it would be more likely to relate to young, old, male and female alike.*

"Another thought is that a video game is always restricted to the TV screen (no physical involvement). We could consider combining the TV screen with a board game. This would give another dimension to the game and a very pleasant one, I feel. It might be nice not to be restricted to the TV screen."

Great ideas, George. I especially like the "separate game board" idea, because it gives readers something else to do besides typing in programs — they get to construct their own game boards! The computer, of course, can keep track of what's happening on the game board, and handle — on the screen — any game action and player confrontation that need take place.

What does all this have to do with Charles Ybarra's food and nutrition idea? Well, Game Idea #2 is a board game based on the four food groups, with any number of players competing to eat well-balanced meals while progressing toward "Dessert," the center of the game board. Special squares to land on include "Fast Food," which pits player against player in a food eating/zapping race, and "Fortune Cookie," which contains surprises similar in nature to the "Chance" cards on a Monopoly board. There is not much space to describe the details of the game this month, so I'll try to fit it in next time.

Anyway, to vote for Game Idea #2, you don't even have to register — just write to **Our Game** and Victor will add your vote to the already growing mandate (and don't forget to include an idea for improving the game).

Our Third Nominee

Game Idea #3 is from a letter by Dale Curtis of Wenatchee, Washington. Dale writes:

"The idea is this: A two-player game that starts each player on opposite sides of the screen with the object to construct a road, railroad track, pipes, wall, etc. to the center and connect with the other's road, etc.

"There can be many levels, since when you complete one level the next level can be harder (more points to connect up, for instance). Of course, there could be things to prevent straight line-constructing (for instance, in constructing a road, there could be trees and houses to go around, angry land owners protesting certain routes, bad weather, or whatever). Also, the scoring can be of any sort: first to make the center, fastest time for both to complete (you might be able to make what one person does dependent on what the other does), which one uses the least amount of track, etc.

"This could be a very interactive game that is non-destructive and that anybody would want to play — with speed of play being relative to the action."

The best thing about Dale's game idea is that it leaves possibilities for new ideas wide open. For example, I recently had the idea that players would have to search the board to find the materials to build their tracks (or walls or roads). You may have other, better ideas. If so, vote for Game Idea #3 and send those ideas in!

Four! Four! Four!

Last, but possibly not least, is Game Idea #4. Patty Wilson, of Lansdale, Pennsylvania, writes:

"I can't truly say that I'm the world's biggest video game fan, but I think a few of them are worthwhile enough to play until you can manage a half-decent score. My biggest complaints about video games are: 1) They move too fast, and 2) What good will it do me tomorrow if I kill 3 million aliens today? Allow me to explain.

"First of all, I could be described as 'laid back.' Sometimes I find it all too difficult (and no fun) to work up the nervous energy required to play many games. Everything happens so fast; you really have to concentrate to keep up, and enjoying the game ***while I'm playing*** *becomes nearly impossible. I would like to see a game that moves at the pace I want it to, so I can really look at the graphics, recover from disasters, and take a breather after a victory. Secondly, I'm a great supporter of educational games that improve the mind, not just hand-eye coordination. No one is ever too old to learn; there must be a fun way to learn how to balance a checkbook or prepare a gourmet meal. Over-cooking a goose in Graphics 7 wouldn't have the unfortunate effect of sending smoke swirling through the house. And miscalculating a few numbers in a game called "Budget Warrior" wouldn't really cost you $97 in bounced checks. I think people are more likely to acquire a new ability if it's presented in an interesting, unique way instead of being learned the hard way."*

Hmmm. Didn't see a game idea in there, did you? Well, that's because there's only the *name* of one: "Budget Warrior." When you vote for Game Idea #4 you are voting for an entertaining video game about the trials and tribulations of household economics and "low" finance! And, since Game Idea #4 hasn't really been invented yet, you get a chance to tell **Our Game** what "Budget Warrior" means to you! One hopes Patty will write back and tell us what she meant...

But Seriously, Folks...

To sum it all up, here are our four nominees:

#1: *In Search of the Loch Ness Monster.* A one player, photogenic action game.

#2: *The Frantic Foods Board Game.* A multi-player, slightly educational, board game with a do-it-yourself board.

#3: *Paths To Glory.* A two-player, head-to-head road-or-something-building game.

#4: *Budget Warrior.* A great name without an idea.

Send your vote in today (to the address printed below), with an accompanying suggestion for improvement of the game idea (or in the case of Game Idea #4, the idea itself). If you don't send your vote in soon, Victor our Terrifying Vote-Tallying Robot will have to visit your home to collect it from you (and he certainly gets grumpy when he has to make house calls).

Playtesting

In the past, **Our Game** has presented tutorials on Developing a Game Idea, Structured Programming, and Debugging. This month we continue the description of the golden path to a finished game by discussing the necessary and, yes, fun (!) practice of playtesting.

For starters, when do I know it is time to playtest my game? Ideally, you should playtest your game as soon as you aren't afraid to show it to people. The sooner you playtest the game, the sooner you'll be aware of changes that should or must be made in your program.

Who should I use to playtest the game? Anyone you can get your hands on! Go out of your way to find people of different ages, sexes, levels of intelligence, and backgrounds. Don't rule out a possible playtester — even a five-year-old can teach you something about your game.

What do I do during the playtesting? Well, this may sound strange, but the best way to treat your playtesters is to keep your mouth shut. Players should be able to run and play the game without any coaching from you. If they really need help or are confused, there are shortcomings in your game.

This all sounds very harsh, but it stems from one basic philosophy: any game should be figure-outable without any written documentation. All necessary information and explanation should be accessable within the game itself.

There are practical reasons behind this philosophy. Let's say you are a salesman in a computer/software store demonstrating new games to potential

customers. A typical customer, Mr. Impatient, sees a couple of games he wants to try. Game A is a simple, fun game. Game B looks more complex; as a matter of fact, it's so complex that you have to look at the documentation to demonstrate the game. Mr. Impatient gets impatient while you are trying to figure it all out, and decides to buy Game A.

This little scenario is typical of video game sales in computer stores. I ought to know — I spent a summer selling software in just this way. What it comes down to is this: people hate to look at written instructions, and prefer games that are simple and clear. Your playtesting will help to show you whether your game is a Game A or a Game B. But if you really want to find out, you have to be silent during playtesting, and watch your playtesters very closely.

What should I tell my playtesters? Encourage your playtesters to make verbal comments, complaints, and suggestions during play and after. You may also want to elicit comments about specific elements of your game that you are unsure about.

Your task during the playtest is to *write down* everything they say, including what they *do* like. Also take notes on difficulties they have or unexpected actions they take. Writing all of this down may seem like work — that's because it is. Playtesting is by far the most valuable method of improving a game, but is entirely worthless if you don't get it all down on paper. Some programmers are a bit lazy and try to remember it all (like I used to do), only to say the next day: "Gosh, I'm sure that Michael recommended *three* things for me to change, but I can only remember *two*..."

One of the DON'Ts of playtesting, mentioned above, was to explain things or give coaching to your playtesters. (Remember: there won't be a copy of *you* sold with every game!) Another DON'T is arguing with playtesters. *Never* argue with a playtester! There are good reasons for this:

a) You *did* ask them for their opinion.

b) You are obviously not trying to learn from their comments — you are just trying to defend your own, possibly not-so-wonderful, game.

c) They probably won't want to playtest for you again; you've made the process unpleasant.

Now don't get me wrong. It's tough not to argue with someone who says: "I don't like the spaceship."

"Why not?" you reply.

"It's uglier than a frog in a blender," says the playtester. At this point it's very difficult not to rejoin:

"Are you kidding? I spent a week designing that space ship! It's the best you can do in 16 by 7 pixels! Why that ship looks just like the Millenium..." etc., etc.

But what you ought to say is: "Ugly, you say? Well, how could I improve it?" Or, better yet, "Draw me a sketch of how you think it ought to look."

It's evident that this approach does more for the both of you than arguing. Remember, you're not out to prove anything to your playtesters; save all the hype for Electronic Arts, Atari, Synapse, or whoever you're trying to sell your game to.

Grill Them!

Once the playtesters have playtested the game to their hearts' content it is time to turn on the high-intensity lights, get out the whip and the black leather gloves, and ask a few questions...heh, heh! Questions like:

*Was it fun? How could it be made more fun?

*Was it easy to use? How could it be made more so?

*Was the level of skill required to play too high/low?

*Did you like the graphics/sound? Do you have any suggestions for improving them? More specifically: Did you like the colors/shapes of things? Did you find the sound pleasant or annoying? Are there any particular effects you would change?

(continued on page 27)

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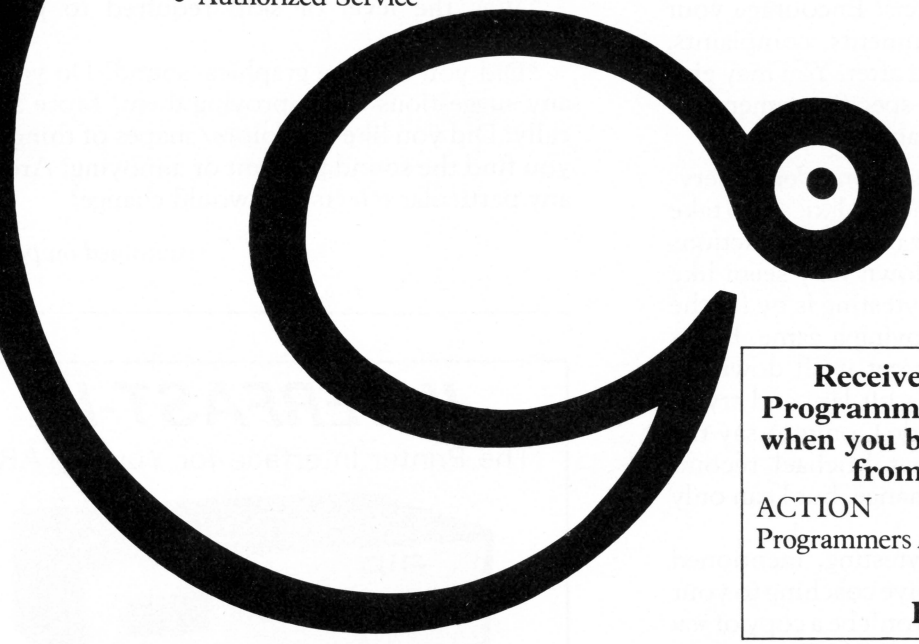

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CIRCLE #116 ON READER SERVICE CARD.

*Was there anything you didn't understand in the game?

*Are there any game options you'd like to have? Were there any options that seem unnecessary?

*How could I make the game more exciting/funny/scary/cute/violent or whatever?

*Is there any information that ought to be included in the game or presented more clearly?

*Do you have any random ideas about the game? Any radical changes you'd find interesting?

As before, write down the answers to all these questions. You may consider your playtesters inexperienced or lacking in taste or judgement, but, like it or not, they represent realistic opinions that differ from yours — opinions that may happen to coincide with whoever screens out incoming games at the Atari Program Exchange, for example. Also, apparently minor comments made by playtesters often inspire game designers to turn an ordinary game into a great game.

Of course, playtesting sometimes isn't all it's cracked up to be. For example, I recently wrote a simple two-player maze game and had some friends of mine try it out. The first playtester, Dan, enjoyed the game immensely. As a matter of fact, we played the game together for three hours. However, I didn't learn much from Dan. Later that night, though, Crazy Bob and I had a go at it. Crazy Bob is not as good at video games as Dan is, and just by watching him I saw faults in my game, especially in the user interface. The next day I made significant improvements in the game. It just goes to show that the less likely a person is as a playtester, the better a playtester they'll be.

What next?

What do I do with all of the stuff I've written down? One of the best ways of using it is to look through and find similar comments that were made by more than one playtester. Add to this special list any suggestions that you think are especially good.

Then it's time to go back to the ol' keyboard and make the changes in your program recommended by the list. You may not agree with some of the suggestions, but it is worthwhile to at least try out other people's ideas. Of course, it is wise to keep a copy of the original game, as well as copies of the program made after each major change. Do *not* change things in your program that your playtesters liked; try to add more of similar things to your game.

Once you've made the changes (and debugged everything), it's time for a whole new round of playtesting! This time, though, you'll have copies of the program containing different versions of certain features, so that playtesters can make a "side-by-side" comparison.

One more question. How do I know when I've got a finished game? This is a difficult question faced by all game programmers. The only proper answer is to use your best judgement. If the complaints of your playtesters are down to a minimum, and they seem to actually be enjoying themselves while playing the game, if new play-testers have little trouble understanding the game, then you're on the way to having a finished product.

On the way? Well, it's not finished yet. You still have documentation to write...which, coincidentally, is the subject of our next **Our Game** tutorial. Stay tuned!

Victor is Waiting!

Yes, Victor our Ferocious Vote-Tallying Robot is waiting for you to send in your vote for best game idea in *Our Game's Special Election Year Game Idea Vote!* Just write us a letter or postcard with the number of one of our four wonderful nominees, along with a suggestion for the improvement of the idea. Our address is:

Our Game
c/o ANALOG Computing Magazine
P.O. Box 23
Worcester, MA 01603

Don't be bashful! If you have something to say about the state of computer/video games in general, or even if you just want to flame about chocolate cupcakes, hyperlipidemia, or Ronald Reagan, don't be afraid to drop us a line!

Next month: gee, even I don't know what's going to be in **Our Game** next month...so get ready for a *total surprise!* And keep those votes pouring in! □

MICRORAM 64K MEMORY BOARD
Microbits Peripheral Products
225 Third Ave., S.W.
Albany, or 97321
$149.95

by Raymond Berube

Since the end of 1983, Atari 600XL owners (and there are thousands of us) have been forced to deal with that dreaded demon of 16K machines: the ERROR 2-OUT OF MEMORY prompt. Frustration would set in. Then the back issues of **ANALOG** would be searched furiously for compression techniques which would save every single "bit" of space. Maybe, with a little luck, the program could be made fit into 16K. Well, 600XL owners take heart. The first in a series of memory expansion packages has appeared. Now your 600XL can be transformed into a member of the smart set, with 64K of RAM. (Well, not really 64K, but more on that later.)

Microbits Peripheral Products has won the race to be first with a memory board, and it has some nice features and some not-so-nice drawbacks. Most importantly it is readily available with a list price of $149.95.

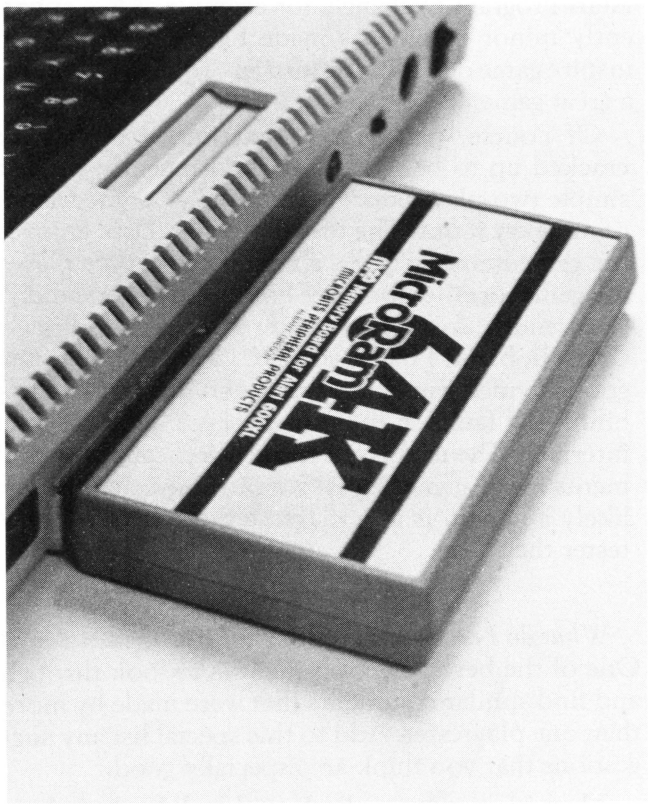
The price is the first drawback of this product. My 600XL only cost me four cents more at $149.99. This price will be firm until Atari or another company makes a comparable unit. So what do you get for your investment of this week's grocery money? You get a suspiciously large box covered by the familiar dark blue MPP sleeve. Slip the sleeve off, open the box, and, sure enough, white foam! Carefully lifting the foam, you find the usual promos for more of MPP's products, a warranty registration card, and a single instruction sheet. Finally you see the unit itself and begin to understand why the box is so big.

The MPP memory board is fully 1″ thick, 3½″ wide, and 7″ long! The unit is completely sealed except for the connector which clearly slips into the parallel bus on the back of the 600XL. Here is another drawback. For the money, why isn't there a duplicate card edge connector on the back edge of the memory unit? Once plugged in, it occupies all of the Atari bus with no further optional connections available.

A few warnings should be mentioned at this point. First: *don't* lift the 600XL with the expander plugged in! It is heavy and will most likely snap off at the bus. The unit has no firm support and flops very easily. Second: *never* insert or remove the board with the power on. If you do you stand a chance of losing your memory! Finally: *don't* try to open the case. It is firmly sealed and tampering with it will break it! I guess MPP doesn't want us to know how little (component-wise) is packed into this large, heavy unit!

If you're like me, you don't own a computer desk, and usually use your child's tea table as a desk. In this case, I recommend you cut a piece of ⅜″ plywood (¼″ is too flimsy) 12″ wide by 18″ long, sanded it, stained it and set my 600XL with its memory board attached onto this tray. Now I can lift my computer without fear of breaking off the board, by simply lifting the tray.

After all these criticisms, do I have any positive observations? You bet I do! My 600XL finally has enough memory to effectively run peripherals like printers, disk drives, modems, etc. This makes the criticisms minor and easy to accept. The installation instructions are concise and well written, and cosmetically the board fits in fairly well with my 600XL.



Microram 64K Memory Board.

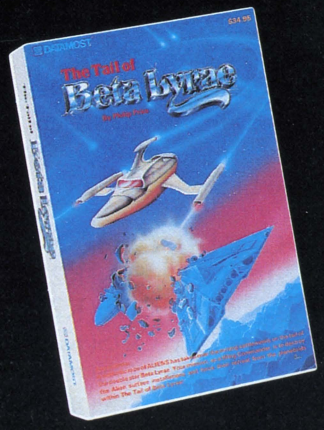
Now, a note about what exactly 64K means to a 600XL. It means 37902 bits of available RAM while using the built-in BASIC. Machine language programs up that availability to about 52K, but Atari and others have promised us many new software products to take full advantage of the available RAM. I'm waiting with excitement.

So after all is said and done, do I recommend you buy MPP's memory board? Yes. If you can afford its price and feel it's an acceptable trade-off for increased RAM, go buy it. If your wife, girl friend or mother refuses to let you spend the grocery money on "more K's," then wait a bit. I'm sure more of the same from other sources is on its way, and surely for less money. □

From out of our minds

The Tail of Beta Lyrae™

By Philip Price



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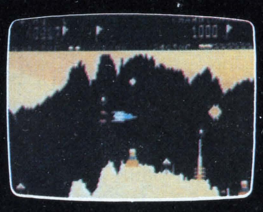

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CIRCLE #118 ON READER SERVICE CARD.

Super Sine

8 Colors in Gr. 8

16K Cassette or 24K Disk

by Edward Loniewski

Super Sine was originally written to demonstrate the very powerful mathematical concept that any complicated curve can be approximated by some combination of sine and cosine functions. In case you're not overly familiar with sines and cosines, they are a pair of curves that trace out a simple wave shape that repeats itself every 360 degrees. They can be thought of as plotting the horizontal and vertical distances of a point on the circumference of a circle as that point moves completely around the circle. These distances are measured from the x- and y-axes that pass through the center of the circle. These curves have two characteristics, called frequency and amplitude, that can be changed in various ways to distort the basic sine wave. By adding or multiplying several sines and cosines together, an almost endless variety of complicated curves can be drawn.

The program described here is a very simple sine wave generator, yet it can produce incredibly beautiful results. It only deals with two curves at a time and only allows for changing the frequency. However, with very little effort, the program can be expanded further.

The frequencies of the 2 curves plotted here are denoted by the variables K1 and K2, which can be assigned any positive value whatever. The fun comes in experimenting with various pairs of frequencies and watching what happens. In addition, eight different patterns or combinations of sines and cosines can be plotted, as shown in the table below.

PATTERN	COMBINATION
1	SIN(K1) + SIN(K2)
2	COS(K1) + COS(K2)
3	SIN(K1) + COS(K2)
4	SIN(K1) * COS(K2)
5	SIN(K1) - SIN(K2)
6	COS(K1) - COS(K2)
7	SIN(K1) * SIN(K2)
8	COS(K1) * COS(K2)

Each pattern can be drawn as a mirror image of itself by using negative pattern numbers. In other words, pattern -5 will plot the mirror image of pattern 5. Thus, there are really 16 patterns available.

The final fancy trick is to allow plotting of more than one pattern on the same graph. All sixteen patterns could be drawn if desired, but usually four or less would be sufficient. All patterns drawn on one graph, though, will have the same pair of frequencies.

Two versions of the program are shown here. The second includes a speedy graphic dump to an Epson printer with GRAFTRAX. If you have a dump routine for a different printer, insert it where appropriate.

Line 101 sets aside space for 450 precalculated sines and cosines (PCS) to save time in plotting later.

Lines 105-107 draw the title and store the PCS values. POKE 710,0 turns the text window black to match the rest of the screen. Only 91 different sines are actually calculated, representing 0 through 90 degrees. All other values are gotten from the symmetric properties of the sine and from the fact that COS(X) = SIN(X+90).

Lines 110-130 clear the screen for a new set of graphs. The POKE's to 709, 710, and 712 set the colors used. X0 and YFAC are scale factors. NPAT counts the patterns used. The PLOT's and DRAWTO's draw the x- and y-axes.

Line 140 asks for the 2 frequencies. Values between 0 and 360 seem to work best, but any positive number will work. The program will end if a negative value is entered.

Line 145 asks for the (next) pattern to be drawn. As described, any value between 1 and 8 or its negative is allowed. An illegal entry will be ignored. Enter 0 when you're done with a particular set of graphs.

Lines 147-148 store the pattern and calculate scale factors.

Lines 150-180 do the plotting of the functions specified. The program essentially plots the curves for 310 degrees (out of 360). Lines 152-154 keep the angles within bounds.

Lines 200-205 sound a beep after each graph and return for another pattern.

Lines 215-220 ask if you want to start a new graph. Otherwise, the program allows for more patterns on the current graph.

After entering the program, SAVE it to a cassette or disk and then get ready for some intriguing experimentation.

To get a good feel for how the program works, RUN the following examples:

- K1=, K2=1, PATTERN 1 will plot a basic sine wave (with the right-most 50 degrees missing). Plot PATTERN -1 on top of this to see how the mirror image looks. Then plot PATTERN 2 and -2 on top to see a basic cosine wave and its mirror image.
- K1=.161, K2=1.161, PATTERN 1 will scale a complete sine wave into the 310 degrees plotted. This factor of 1.161 will be used several times later.
- K1=2, K2=2, PATTERN 1 will put twice as many hills and valleys as before, but still with a definite rhythm.
- K1=3, K2=4, PATTERN 3 shows some interesting bumps. Plot PATTERN -3 on top also.
- Radically increase the frequency to K1=10, K2=10, PATTERN 4 and look closely at the plot, which is really made up of bunches of short vertical lines. Notice that some parts appear white, some green, and others blue. This is all a consequence of color artifacting. Its effect will become even more apparent shortly.
- Try K1=21, K2=22, PATTERN 2 and notice the colors stand out even more.
- K1=40, K2=42, PATTERN 2 reveals definite bars of color. Remember that Gr.8 is only supposed to get you 1½ colors. But already you should be able to distinguish 5 colors on the screen at one time. Color artifacting yields various colors depending upon whether the left or right side of a color block is turned on, or if adjacent halves are turned on.
- We are now ready for eye-openers. K1=60, K2=61, PATTERN 6 or K1=87, K2=90, PATTERN 3 should give you a good idea of the power and beauty of this program.

The following table yields some instructive and entertaining figures. When more than one pattern is given, study how the colors change with each succeeding plot. Sometimes the colors get filled in, sometimes they reverse, and sometimes they get cancelled to white or grey. Some of these combinations will actually wind up with eight colors on the screen at one time.

K1, K2	PATTERNS
90, 92	5, -5
2, 179	1, -1
118, 120	3, -3
300, 303	7, -7
44, 45	4, -4
5, 90	2, 6
87, 93	1, -1, 4, -4
1.5, 2.85	3, -3, 4, -4
10, 120	4, -4
100, 101	4, -4
6, 7.161	7, -7, -8, 8
40, 42.32	5, -5, 6, -6

(Continued next page.)

If you use the printer version of the program, the character in Line 102 is a ♥ (CTRL,). Change Line 145 to read 210. Add Line 210 and all of Lines 9000-9060.

The rest, now, is up to you. Experiment as much as you like. Try adapting the program to three or more frequencies, or add different patterns, or placing different frequencies on the same graph. If you're like me, you'll run out of time long before you run out of ideas.

By the way, this program can *even* be used to plot sines and cosines. □

```
100 REM SUPER SINE
101 DIM PCS(450),PAT(16),YN$(1)
105 DEG :GRAPHICS 2:POKE 710,0:POSITIO
N 5,3:PRINT #6;"S U P E R":POSITION 6,
6:PRINT #6;"s i n e"
106 POKE 752,1:PRINT :PRINT "
PLEASE STAND BY"
107 FOR I=0 TO 90:X=SIN(I):PCS(I)=X:PC
S(I+180)=-X:PCS(180-I)=X:PCS(360-I)=-X
:PCS(I+360)=X:NEXT I
110 GRAPHICS 8:POKE 709,14:POKE 710,0:
POKE 712,68
120 COLOR 1:X0=10:YFAC=39:NPAT=0:TRAP
110
130 PLOT 0,80:DRAWTO 319,80:PLOT X0,0:
DRAWTO X0,159:PLOT 0,159:DRAWTO 319,15
9
140 PRINT "K1,K2=";:INPUT K1,K2
145 PRINT "PATTTERN";:INPUT ZT:IF ZT=0
 THEN 215
147 ARG1=-K1:ARG2=-K2:NPAT=NPAT+1:PAT(
NPAT)=ZT
148 PT=ABS(ZT):ZFAC=-YFAC*SGN(ZT)
150 FOR X=X0 TO 319
152 ARG1=ARG1+K1:ARG2=ARG2+K2
153 IF ARG1>360 THEN ARG1=ARG1-360:GOT
O 153
154 IF ARG2>360 THEN ARG2=ARG2-360:GOT
O 154
160 IF PT=1 THEN Y=80+ZFAC*(PCS(ARG1)+
PCS(ARG2))
162 IF PT=2 THEN Y=80+ZFAC*(PCS(ARG1+9
0)+PCS(ARG2+90))
164 IF PT=3 THEN Y=80+ZFAC*(PCS(ARG1)+
PCS(ARG2+90))
166 IF PT=4 THEN Y=80+ZFAC*(PCS(ARG1)*
PCS(ARG2+90))
168 IF PT=5 THEN Y=80+ZFAC*(PCS(ARG1)-
PCS(ARG2))
170 IF PT=6 THEN Y=80+ZFAC*(PCS(ARG1+9
0)-PCS(ARG2+90))
172 IF PT=7 THEN Y=80+ZFAC*(PCS(ARG1)*
PCS(ARG2))
174 IF PT=8 THEN Y=80+ZFAC*(PCS(ARG1+9
0)*PCS(ARG2+90))
178 IF X=X0 THEN PLOT X,Y
179 IF X<>X0 THEN DRAWTO X,Y
180 NEXT X
200 SOUND 0,40,10,6:FOR W=1 TO 50:NEXT
 W:SOUND 0,0,0,0
205 GOTO 145
215 PRINT "NEW GRAPH (Y/N)";:INPUT YN$
:IF YN$<>"Y" THEN 145
220 GOTO 110
```

●

CHECKSUM DATA

(See page 21)

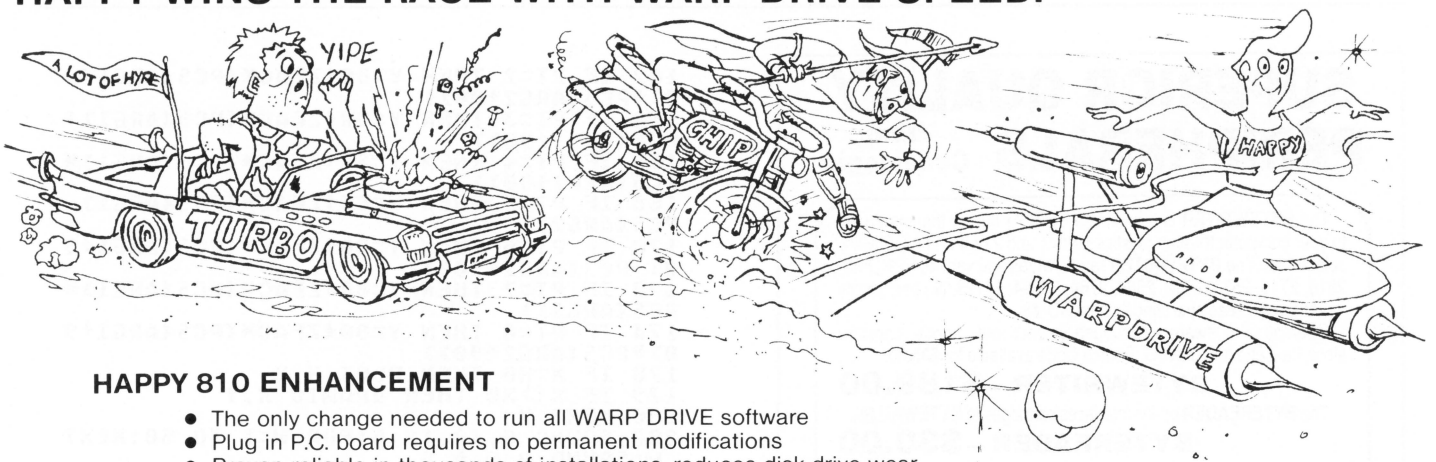
```
100 DATA 583,934,335,770,181,188,192,8
04,70,261,369,618,680,700,634,7319
154 DATA 643,180,772,472,474,206,791,2
00,792,686,256,782,789,707,574,8324
220 DATA 694,694
```

Printer version.

```
100 REM SUPER SINE (PRINTER VERSION)
101 DIM PCS(450),PAT(16),YN$(1)
102 DIM TABZ$(15),XOUT$(192),TST$(192)
:TABZ$="                I":TST$="♥":TST$
(192)="♥":TST$(2)=TST$(1)
105 DEG :GRAPHICS 2:POKE 710,0:POSITIO
N 5,3:PRINT #6;"S U P E R":POSITION 6,
6:PRINT #6;"s i n e"
106 POKE 752,1:PRINT :PRINT "
PLEASE STAND BY"
107 FOR I=0 TO 90:X=SIN(I):PCS(I)=X:PC
S(I+180)=-X:PCS(180-I)=X:PCS(360-I)=-X
:PCS(I+360)=X:NEXT I
110 GRAPHICS 8:POKE 709,14:POKE 710,0:
POKE 712,68
120 COLOR 1:X0=10:YFAC=39:NPAT=0:TRAP
110
130 PLOT 0,80:DRAWTO 319,80:PLOT X0,0:
DRAWTO X0,159:PLOT 0,159:DRAWTO 319,15
9
140 PRINT "K1,K2=";:INPUT K1,K2
145 PRINT "PATTTERN";:INPUT ZT:IF ZT=0
 THEN 210
147 ARG1=-K1:ARG2=-K2:NPAT=NPAT+1:PAT(
NPAT)=ZT
148 PT=ABS(ZT):ZFAC=-YFAC*SGN(ZT)
150 FOR X=X0 TO 319
152 ARG1=ARG1+K1:ARG2=ARG2+K2
153 IF ARG1>360 THEN ARG1=ARG1-360:GOT
O 153
154 IF ARG2>360 THEN ARG2=ARG2-360:GOT
O 154
160 IF PT=1 THEN Y=80+ZFAC*(PCS(ARG1)+
PCS(ARG2))
```

(Continued next page.)

HAPPY WINS THE RACE WITH WARP DRIVE SPEED!



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Unenhanced whole disk (ATARI rev C fast format) read time: 89 seconds
ENHANCED 810 whole disk (any format) read time with standard software: 68 seconds
ENHANCED 810 whole disk (any format) read time with WARP DRIVE software: 43 seconds
Standard software whole disk write and verify time: 238 seconds
WARP DRIVE software whole disk write and verify time: 62 seconds

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WARP SPEED MULTI DRIVE HAPPY BACKUP PROGRAM
- Same features as above plus support of multiple ENHANCED drives
- Can be used with up to 4 ENHANCED drives
- Source and all destination drives read and write in parallel
- Format write and verify 3 complete disks in less than 3 minutes

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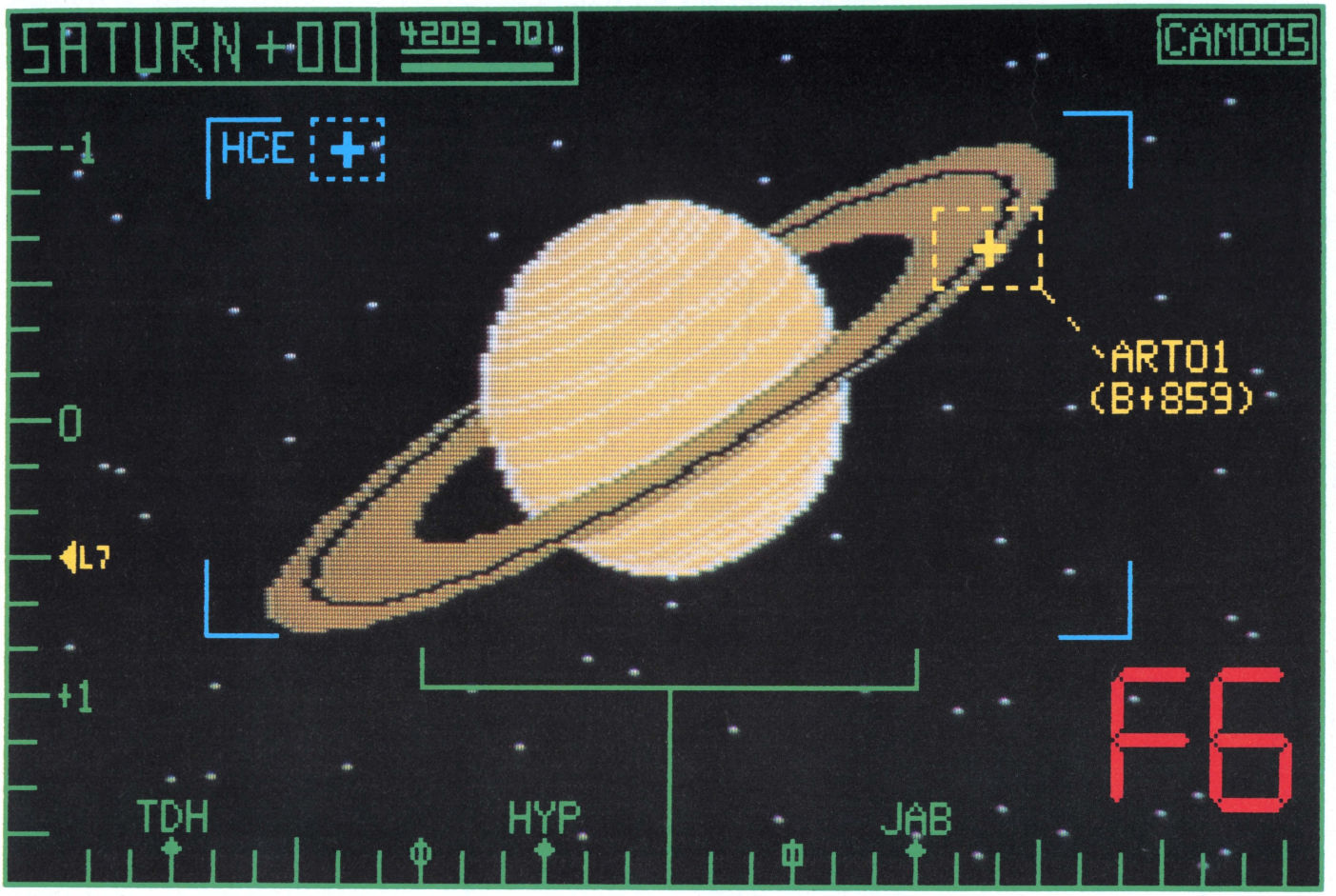
CIRCLE #120 ON READER SERVICE CARD.

```
162 IF PT=2 THEN Y=80+ZFAC*(PCS(ARG1+9
0)+PCS(ARG2+90))
164 IF PT=3 THEN Y=80+ZFAC*(PCS(ARG1)+
PCS(ARG2+90))
166 IF PT=4 THEN Y=80+ZFAC*(PCS(ARG1)*
PCS(ARG2+90))
168 IF PT=5 THEN Y=80+ZFAC*(PCS(ARG1)-
PCS(ARG2))
170 IF PT=6 THEN Y=80+ZFAC*(PCS(ARG1+9
0)-PCS(ARG2+90))
172 IF PT=7 THEN Y=80+ZFAC*(PCS(ARG1)*
PCS(ARG2))
174 IF PT=8 THEN Y=80+ZFAC*(PCS(ARG1+9
0)*PCS(ARG2+90))
178 IF X=X0 THEN PLOT X,Y
179 IF X<>X0 THEN DRAWTO X,Y
180 NEXT X
200 SOUND 0,40,10,6:FOR W=1 TO 50:NEXT
 W:SOUND 0,0,0,0
205 GOTO 145
210 PRINT "PRINTER (Y/N)";:INPUT YN$:I
F YN$="Y" THEN GOSUB 9000
215 PRINT "NEW GRAPH (Y/N)";:INPUT YN$
:IF YN$<>"Y" THEN 145
220 GOTO 110
9000 OPEN #7,8,0,"P:":TRAP 9060:PRINT
#7:PSV=PEEK(559):POKE 559,0:A=PEEK(88)
+256*PEEK(89)
9002 IF PEEK(1536)=104 THEN 9010
9004 RESTORE 9006:FOR K=1536 TO 1577:R
EAD X:POKE K,X:NEXT K
9006 DATA 104,104,133,204,104,133,203,
104,133,206,104,133,205,162,191,160,0,
177,203,72,138,168,104,145,205
9008 DATA 202,240,13,24,165,203,105,40
,133,203,144,234,230,204,208,230,96
9010 PRINT #7;TABZ$(1,14);"   K1=";K1;
"     K2=";K2
9011 PRINT #7;TABZ$(1,14);"   PATTERN:
 ";
9012 FOR J=1 TO NPAT:PRINT #7;PAT(J);"
  ";:NEXT J:PRINT #7
9014 PRINT #7;CHR$(27);CHR$(65);CHR$(8
)
9015 XOUT$=CHR$(174):XOUT$(192)=CHR$(1
74):XOUT$(2)=XOUT$(1)
9016 PRINT #7;TABZ$;CHR$(27);CHR$(75);
CHR$(192);CHR$(0);XOUT$
9020 FOR J=A TO A+39:XOUT$=TST$:Z=USR(
1536,J,ADR(XOUT$))
9023 IF XOUT$=TST$ THEN PRINT #7;TABZ$
:GOTO 9045
9025 PRINT #7;TABZ$;CHR$(27);CHR$(75);
CHR$(192);CHR$(0);XOUT$
9045 NEXT J
9047 XOUT$=CHR$(117):XOUT$(192)=CHR$(1
17):XOUT$(2)=XOUT$(1)
9048 PRINT #7;TABZ$;CHR$(27);CHR$(75);
CHR$(192);CHR$(0);XOUT$
9050 PRINT #7;CHR$(27);CHR$(64):PRINT
#7:POKE 559,PSV:TRAP 40000:CLOSE #7:RE
TURN
9060 PRINT #7;"ERROR-";PEEK(195);" AT
LINE ";PEEK(186)+256*PEEK(187):GOTO 90
50
```

CHECKSUM DATA

(See page 21)

```
100 DATA 75,934,818,335,770,181,188,19
2,804,70,246,369,618,680,700,6980
153 DATA 634,643,180,772,472,474,206,7
91,200,792,686,256,782,789,707,8384
210 DATA 182,574,694,654,606,535,962,7
23,575,936,552,810,155,588,219,8765
9023 DATA 362,587,517,162,595,184,194,
2601
```



artwork by Tom Hudson

BATTLE IN THE B-RING

16K Cassette or 24K Disk

by Lew Thomits, Jr.

The idea for this game came from an article in *Analog — Science Fiction/Science Fact Magazine* (no relation to **ANALOG Computing**). The article, entitled *Blivit in the B-Ring*, was written by Richard C. Hoagland. In it, Hoagland presented facts and speculation about an object in Saturn's B-Ring that had cleared a hundred-meter gap between the rings. Several explanations for this phenomenon were presented, such as a tiny, primordial black hole or an extraterrestrial artifact. For purposes of this game, I chose the latter.

Typing it in.

Before typing anything, look at the listings accompanying this article.

Listing 1 is the BASIC data and data checking routine. This listing is used to create both cassette and disk versions of **Battle in the B-Ring**. The data statements are listed in hexadecimal (base 16), so the program will fit in 16K cassette systems. This makes typing more difficult, but it's a necessary evil.

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6. Variety	■		■		
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9. Compatibility	■		■		
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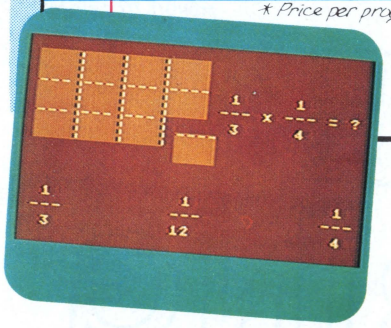

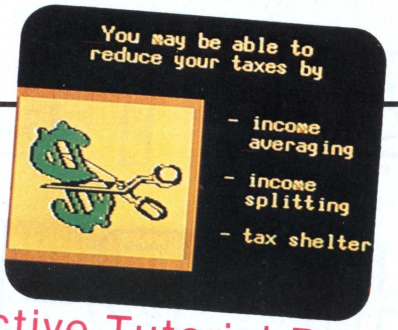

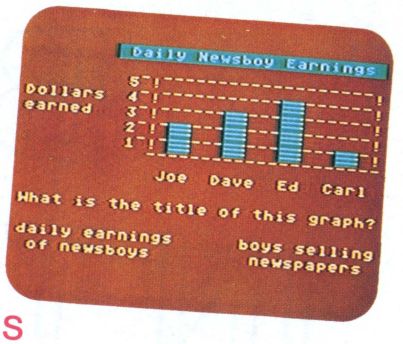

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Listing 2 is the assembly-language source code for **Battle in the B-Ring**, created with the OSS MAC/65 assembler. You *do not* have to type this listing to play the game! It is included for those readers interested in assembly language.

Follow the instructions below to make either a cassette or disk version of **Battle in the B-Ring**.

Cassette instructions.

1. Type **Listing 1** into your computer using the BASIC cartridge, and verify your typing with **C:CHECK** (see page 21).

2. Type RUN and press RETURN. The program will begin and ask:

MAKE CASSETTE (0) OR DISK (1)?

Type 0 and press RETURN. The program will checking the DATA statements, printing the line number of each as it goes. It will alert you if it finds any problems. Fix any incorrect lines and re-RUN the program if necessary, until all errors are eliminated.

3. When all DATA lines are correct, the computer will beep twice and prompt you to "READY CASSETTE AND PRESS RETURN." Insert a blank cassette in you recorder, press the RECORD and PLAY buttons simultaneously and hit RETURN. The message "WRITING FILE" will appear, and the program will create a machine-language boot tape version of **Battle in the B-Ring**, printing each DATA line number as it goes. When the READY prompt appears, the game is recorded and ready to play. CSAVE the BASIC program onto a separate tape before continuing.

4. To play the game, rewind the tape created by the BASIC program to the beginning. Turn your computer OFF and remove all cartridges. Press the PLAY button on your recorder and turn ON your computer while holding down the START key. If you have a 600 or 800 XL computer, you must hold the START and OPTION keys when you turn on the power. The computer will "beep" once. Hit the RETURN key and **Battle in the B-Ring** will load and run automatically.

Disk instructions.

1. Type **Listing 1** into your computer using the BASIC cartridge, and verify your typing with **D:CHECK2** (see page 21).

2. Type RUN and press RETURN. The program will ask:

MAKE CASSETTE (0) OR DISK (1)?

Type 1 and press RETURN. The program will begin checking the DATA statements, printing the line number of each as it goes. It will alert you if it finds any problems. Fix any incorrect lines and re-RUN the program if necessary, until all errors are eliminated.

3. When all DATA lines are correct, you will be prompted to "INSERT DATA WITH DOS, PRESS RETURN." Put a disk containing DOS 2.0S into drive #1 and press RETURN. The message "WRITING FILE" will appear and the program will create an AUTORUN.SYS file on the disk, displaying each DATA line number as it goes. When the READY prompt appears, the game is ready to play. Be sure the BASIC program is SAVEd before continuing.

4. To play the game, insert the disk containing the AUTORUN.SYS file into drive #1. Turn your computer OFF, remove all cartridges and turn the computer back ON. **Battle in the B-Ring** will load and run automatically.

The game.

In the B-Ring of Saturn, a huge extraterrestrial artifact has been discovered. It is a Bussard ramjet of alien manufacture; a huge, hydrogen-gulping behemoth that has traveled between stars and is now orbiting, dormant, around our sixth planet. The two most powerful nations on earth have launched missions to retrieve the alien vessel and study its advanced technology. Neither side wishes to share the prize, so a battle is inevitable.

To play the game, plug joysticks into ports one and two. Once the program has been loaded, the menu will appear. Pressing the OPTION key will highlight the game selection (collisions, ring density, ring speed). Pressing the SELECT key will choose the particular variation (non-scoring or scoring collisions; low, medium or high density rings; and slow or fast ring speed). Pressing START returns you to the game screen, where gameplay is initiated by pressing the joystick trigger button. Pressing any of the three console buttons during gameplay returns you to the menu.

There are many dangers in Saturn's rings. You must avoid collisions with the chunks of rocks and ice that constitute the rings themselves, and the electrical discharges that randomly arc across the gap. You should also be aware that the artifact is still active and will fire its missiles at anything in its path.

Player movements are controlled by the joysticks. Your missiles are fired by pressing your trigger button. Each player may have only one missile on screen at a time. Missile directions, either left or right, are controlled by the computer. Player destruction occurs when your saucer has suffered a total of ten collisions with missiles or ring debris. Collision counters appear at the bottom of the screen. If the non-scoring option is used, collisions with ring debris do not count. Contacts with the white-hot nozzle of the artifact or the electrical discharges are instantly

fatal. Colliding with the opposing player's saucer results in the destruction of both players.

To win the game, you must hit the rocket nozzle of the artifact with one of your missiles. The artifact will stop, and the nozzle will begin to cool. Once it has cooled you must dock your saucer with it. If the other player has been destroyed you have won, and the game is over. If not, then you're a sitting duck. You can neither fire nor retreat while docked, but your opponent retains his mobility. It's either him or you! Only one person can rescue the alien ship! □

BASIC listing.

```
10 REM *** BATTLE IN THE B RING ***
20 TRAP 20:? "MAKE CASSETTE (0), OR DI
SK (1)";:INPUT DSK:IF DSK>1 THEN 20
30 TRAP 40000:DATA 0,1,2,3,4,5,6,7,8,9
,0,0,0,0,0,0,0,10,11,12,13,14,15
40 DIM DAT$(91),HEX(22):FOR X=0 TO 22:
READ N:HEX(X)=N:NEXT X:LINE=990:RESTOR
E 1000:TRAP 120:? "CHECKING DATA"
50 LINE=LINE+10:? "LINE:";LINE:READ DA
T$:IF LEN(DAT$)<>90 THEN 220
60 DATLIN=PEEK(183)+PEEK(184)*256:IF D
ATLIN<>LINE THEN ? "LINE ";LINE;" MISS
ING!":END
70 FOR X=1 TO 89 STEP 2:D1=ASC(DAT$(X,
X))-48:D2=ASC(DAT$(X+1,X+1))-48:BYTE=H
EX(D1)*16+HEX(D2)
80 IF PASS=2 THEN PUT #1,BYTE:NEXT X:R
EAD CHKSUM:GOTO 50
90 TOTAL=TOTAL+BYTE:IF TOTAL>999 THEN
TOTAL=TOTAL-1000
100 NEXT X:READ CHKSUM:IF TOTAL=CHKSUM
 THEN 50
110 GOTO 220
120 IF PEEK(195)<>6 THEN 220
130 IF PASS=0 THEN 170
140 IF  NOT DSK THEN 160
150 PUT #1,224:PUT #1,2:PUT #1,225:PUT
 #1,2:PUT #1,0:PUT #1,32:CLOSE #1:END
160 FOR X=1 TO 79:PUT #1,0:NEXT X:CLOS
E #1:END
170 IF  NOT DSK THEN 200
180 ? "INSERT DISK WITH DOS, PRESS RET
URN";:DIM IN$(1):INPUT IN$:OPEN #1,8,0
,"D:AUTORUN.SYS"
190 PUT #1,255:PUT #1,255:PUT #1,0:PUT
 #1,32:PUT #1,136:PUT #1,45:GOTO 210
200 ? "READY CASSETTE AND PRESS RETURN
";:OPEN #1,8,128,"C:":RESTORE 230:FOR
X=1 TO 40:READ N:PUT #1,N:NEXT X
210 ? :? "WRITING FILE":PASS=2:LINE=99
0:RESTORE 1000:TRAP 120:GOTO 50
220 ? "BAD DATA: LINE ";LINE:END
230 DATA 0,28,216,31,255,31,169,0,141,
47,2,169,60,141,2,211,169,0,141,231,2,
133,14,169,56,141,232,2
240 DATA 133,15,169,0,133,10,169,32,13
3,11,24,96
1000 DATA D8A203BDC02A9DC402BDBC2A9DDC
06CA10F1A9008D08D2A9038D0FD24C302C48A5
CA8D04D4A492C8D0002684048,46
1010 DATA A5CC8D04D4A9398D0002684048A9
028D0AD48D01D4A9498D0002684048A5CA8D04
D4A9568D0002684048A5C98D,763
1020 DATA 04D4A91F8D0002684BA901ACDD06
A200205CE4A5C9C909D00160C6C9A5C9F00160
A99885C9A20FAD0506C96AF0,975
1030 DATA 061869014C9020A9009D02060980
9D33064980CACACAD0F160A902A200ACDD0688
205CE4A5C9C909D00160C6CA,901
1040 DATA A5CAF02BA5B8F026C6B8A5B88D02
D0AEE206A018BD532A91B2E88810F78EE206E0
4BD00AA2008EE2068E02D086,31
1050 DATA B860A90885CAA20CAD1506C96AF0
061869014CF820A9009D120609809D26064980
CACACAD0F1A5B8D033AD0AD2,181
1060 DATA 290F85CD186902186D1E06A002D9
FZ06F0048810F860A5CD0A0A0A1869385B88D
02D0A9C88D00D28D01D2A904,740
1070 DATA 8D1E0260A9C08D0ED4ADDB068D01
D4A5C98D04D4A5CBC910D0034C62E4ADEB06F0
0DC988F009EEEB06ADEB068D,697
1080 DATA 03D2E6CBA5CB2901F0034C62E4C6
CCA5CB290F85CB4AAABD4B2A8D2410A5B9F007
C6B9A5B98D03D0A5CCF0034C,673
1090 DATA 62E4A90885CCAD2206C908D00FA2
E086B98E02D2A2818E03D28EEB06C924D00BA2
008E02D28E03D28EEB06A6C1,318
1100 DATA E000D04C18C90D904718C91EB042
38E90D0A0A0A85CDA9CC38E5CD85CDA2001885
B0C96B900C18C982B0071885,397
1110 DATA B6C5CD9008E8E002D0E84C1222A5
CD85C18D07D0A9268D00D2A98E8D01D2A9058D
1E02AD2206C93FF006186901,632
1120 DATA 4C2122A9008D22068D25064C62E4
A21FA90095B09DE006CA10F8A90985C9A91085
CBA9048DD606A900AAA8A918,523
1130 DATA 8D07D4A91B85C3A91C85B4A91D85
B5A91E85B3A9E085CFA91285BB8DF402A90085
BA85CEAAA8B1CE91BAC8D0F9,103
1140 DATA E6BBE6CFE8E002D0F0C6BBC6BBA0
00A90885BAB90F2991BAC8C078D0F6A200A0D0
86BABD0B2A91BAE8E038F008,10
1150 DATA C8D0F3E6BB4C9922A24DA0008C2F
02BDC42A9D0006CA10F7A9068C30028D3102AD
060685BB84BA98AA91BAC8D0,425
1160 DATA FBE6BBE8E00BD0F4A200AD060685
BBADDC0685CF86BAAD0AD22903A8B9072A85CE
18AC0AD2C06BB0F8B1BAC900,619
1170 DATA D0F2AD0AD2290FF0F905CE91BAE8
E4CFD0D7A20018A5BA698085BA9002E6BBA5BB
CD1F06D007A4CF88888884CF,218
1180 DATA CD2606D0B7AD1F0685BBAD0AD229
03A8B9072A85CEAD0AD22903A8B9072A85CF18
AD0AD2F0FAC969B0F685BA9D,856
1190 DATA F206A000B1BAD0EBAD0AD2290FF0
F905CE91BAAD0AD2290FF0F905CFA08091BAE8
E003D0B8A900A2129D00079D,840
1200 DATA 8007CA10F7A014AD060685BB85CF
A96B85CEE886BAB1BA91CE8810F9A014E8A5BA
18698085BA9002E6BBA5CE18,44
1210 DATA 698085CE9002E6CFE012D0DCA003
B9472A9920108810F7A9108D64068D6E06A900
AA8D63068D6D06A91885BB8A,111
1220 DATA 85BAA891BAC8D0FBE6BBE8E008D0
F4A205A9009D02D0CA10FAA96C85B2A9038D1D
D0A93E8D2F028D1ED0A9788D,460
1230 DATA 01D085B78D00D085B6A9C485B1A9
2385B085BAA5B485BBA5B185CEA5B585CFA007
B9862991BA91CE8810F6E6CF,232
1240 DATA E6CFA074A90085CEA90191CEC8C0
7CD0F9A070A9C091C2A07F91C2A203BDB802A9D
C002CA10F7A9088D04D485CA,810
1250 DATA 85CC8D1FD085C5A90985C4A9638D
2602A9208D2702A901A200A004205CE4A9A08D
2802A9208D2902A902A200A0,434
1260 DATA 03205CE4A907A221A03F205CE4A9
208D0102A91F8D0002A9C08D0ED4A9018D1BD0
AD8402D0034CC024AD8502D0,35
1270 DATA F3A90F8D1C02AD1C02D0FB85CBA9
0885C9A9018D1C02E6C8A5C82901AA85C8B5B6
D0034C0127A5CBC910D017EE,567
1280 DATA E806ADE806291F8DE806D00AADC3
02C994F003CEC302BDE006F04EFEE606BDE606
29039DE606D021BCAA2ABDEC,405
1290 DATA 06C980F00CDEEC06BDEC06990502
4C3525A9009904D29905D29DEC06BDC002C99F
F00CFEC002FEC002FEC0024C,139
1300 DATA 0127BDE6062901F0034C01274C27
28BDEE06F0034C1426AD08D0F01EA00084C18C
07D08C1ED0C904F010AAC886,817
1310 DATA C2A0062066266A6C220EF27A6C8BD
0CD0F029C904D0034C0F28C908D01BADC302C9
94F0034C0F28BCA02AB9B600,916
1320 DATA 8D1ED0D0034CEF284C01274C8728
BD00D0F0092091272077282OD828BD08D0F040
C904D00620D8284C0126C908,309
1330 DATA D01520D828A91085CBA9008D2410
8D02D28D03D24C0126B4C6AACABDE006F0034C
01272066268A4AAA20EF27A6,89
1340 DATA C820912720D828BD04D0F0398D1E
D0207728ADDE06D00320EF27FEEE06BDEE06C9
04D005A9009DEE06B5C4A8B9,632
```

```
1350 DATA F629C906D00B18B5B0C975A904B0
02A905A82066264C0127BD8402D009854DB5BF
D0034CB127BD7802C90FD006,391
1360 DATA 20C8264C012738E905A895C42066
264C0127B5B61879E229C9C1F009C92FF0059D
00D095B6B5B485BBB5B01879,662
1370 DATA EC29C9C5F041C922F03D85BA95B0
A007B9862991BA8810F8FEE406BDE40629079D
E406A8B9A22AA00491BABDE9,904
1380 DATA 06F00160BDE4062901A8BDAA2AAA
B9AC2A9D04D2A9A59D05D260B5B085BAB5B485
BBFEE406BDE406290F9DE406,738
1390 DATA 4AA889A22AA00491BABDE906F001
60BDE40629034AA8BDAA2AAAB9AE2A9D04D2A9
A59D05D260A5BFF005A20020,278
1400 DATA C228A5C0F005A20120C228A5C1F0
07C6C1A5C18D07D0AD1E02D0068D00D28D01D2
AD1FD0C907F0034CEF28ADE9,999
1410 DATA 06F005A200207727ADEA06F005A2
01207727A5BEF024EEF106ADF10629038DF106
D017A5BE85C2A9008D06D085,151
1420 DATA BEA004B1C259B22A91C28810F6AD
1C02D0FB4CD024FEE906FEE906BDE906C930F0
07BCAA2A9904D260A9009DE9,236
1430 DATA 0660A5BEF00160B5BF8D06D0B5BC
38E90285BE85C2A004B1C219B22A91C28810F6
6018A5B6C5B7BD432A9003BD,65
1440 DATA 452A95C6BCAA2AA9089904D29DE9
06A98B9905D2B4C6B5B61879002A95BFB5B018
698595BC85C2A000B1C21DB0,698
1450 DATA 2A91C24C4D26207728BC9E2AB964
06186901C91AF004996406604A91099640 6A911
99630668682077 28BCAA2AA9,952
1460 DATA C89904D2A98F9905D29DEC06A990
9DC002B5B085BAB5B485BB86C2BDE006AAA007
BD8E2991BAE88810F7E040F0,565
1470 DATA 098AA6C29DE0064C0127A900A6C8
9DE0069D00D095B695B08D1ED0BCAA2A9904D2
9905D2EEF006ADF006C902D0,346
1480 DATA 034CEF284C0127A9C88D00D2A98E
8D01D2A9058D1E0260207728A200A000A99E8D
C0028DC102A5B185BAA5B585,297
1490 DATA BBA5B485B1BD8E2991BA91B0E8C8
C008D0F3A9028D1E02A009AD1E02D0FBE040D0
E34CEF28B4C6B5BF1879E229,654
1500 DATA C9DCF00AC928F00695BF9D04D060
A9009D04D095BF8D1ED0A8B5BC85C2B1C25DB0
2A91C260A91E8D1C02AD1C02,428
1510 DATA D0FBA0079900D09900D28810F7A9
1085CBA90985C94C302C0018387F7E183C2000
1C7E7F3C180000001 03C7808,396
1520 DATA 00000000187E3E7C6400183E7C3C
187E3C7800607C383C7E06001C3C1E3C7E7E38
0000001038 1C000000000018,510
1530 DATA 2000000000000387E1830000000
0000183C7E7800003C3E1E7C38200000000000
3F6E34000018783C3E1C0000,9
1540 DATA 007C3E3C1C3E7800001038FEFEFE
380000084018FEAAFE30048024807EAAFD1000
2400522C293C402400910842,620
1550 DATA 2A4A1022910010815200928920 80
0140028051400100800000418000000000000
0000000302C393200110000,479
1560 DATA 0000302C39320012000001010100
FFFFFF00000001FF000001FF000001FF010006
0005040200090800000 90000,276
1570 DATA 00FE004080C0FF3F1F0000000000
FFFFFF0080000000FFFFFF1F0F070307FEFEDE
0200000000FCF8F0E0000000,552
1580 DATA 00FEFCF8F000000000F8F0E0C000
0000000206060 29A1B1CDD9F9EA00000000000
1008101808100810080810081008100808
1810100808041008081008 10,85
1600 DATA 0804081020201808100C04081008
1010080800 0A01007EBEDEEEF6FAFCFE0002A0
AAB4BE030C201030302010CA,229
1610 DATA 469E9E0A040000282544797070 70
2056000756000856000956000A56000B805600
0C56000D56000E56000FB0D6,654
1620 DATA 0010560010B056800F56800E5680
0D56800C8056800B56800A5680095680085680
0746CE2946600620410006 70,805
1630 DATA 7070704738 2B0770465D2B707047
FE2B470D2C70476E2B478D2B70477E2B47B42B
7041122B0000000000626174,142
1640 DATA 746C6500696E0000000000000000
0000007468650062007 2696E6700000000002 2
39002C25370034282F2D2934,37
1650 DATA 3300000000F2E9EEE700E4E5EEF3
E9F4F90000000000F2E9EEE700F3F0E5E5E400
0000000000000ACAFB70000,339
1660 DATA 0000000000000ADA5A4A9B5AD00
0000000000000A8A9A7A800000000000000000
00B3ACAFB700000000000000,745
1670 DATA 00A6A1B3B400000000000000003 2
292E270024252E3329343900000000032292E
270033025252400000000000,312
1680 DATA E3EFECECE9F3E9EFEEF300000000
00232F2C2C2933292F2E330000000000000B3
A3AFB2A9AEA7000000000000,331
1690 DATA AEAFAEB3A3AFB2A9AEA700000000
00A9008D2F02ACDF06A9E08DF402A9028DDB06
A912A22B8D30028E3102A93E,143
1700 DATA 8D2F02AD1FD0C906D00B8CDF06A9
1420662D4C2A22C903D059C001F01BC002F02E
A9EFA22B8D212B8E222BA9D0,927
1710 DATA A22B8D282B8E292B4CB12CA96EA2
2B8D282B8E292BA9E0A22B8D2F2B8E302B4CB1
2CA97EA22B8D2F2B8E302BA9,305
1720 DATA FEA22B8D212B8E222BC8C003D002
A000A92820662D4C512CC905D08DC001F02DC0
02F06AADDE06F012A9008DDE,318
1730 DATA 06A90DA22C8D242B8E252B4C5E2D
A9018DDE06A91CA22C8D242B8E252B4C5E2DAD
DC06C90AF016C90CF024A90A,508
1740 DATA 8DDC06A98DA22B8D2B2B8E2C2B4C
5E2DA90C8DDC06A99AA22B8D2B2B8E2C2B4C5E
2DA90E8DDC06A9A7A22B8D2B,83
1750 DATA 2B8E2C2B4C5E2DADDD06C904F012
A9048DDD06A9B4A22B8D322B8E332B4C5E2DA9
038DDD06A9C0A22B8D322B8E,695
1760 DATA 332BA91E20662D4C512C8D00D2A9
AF8D01D2A90F8D1C02AD1C0209A08D01D249A0
D0F48D00D28D01D260000000,978
```

•

CHECKSUM DATA

(See page 21)

```
10 DATA 322,351,496,811,423,729,200,60
3,555,573,694,613,29,205,214,6818
160 DATA 771,198,962,631,491,30,155,11
4,169,239,827,872,735,180,898,7272
1060 DATA 804,250,194,78,971,848,833,2
00,347,960,439,220,298,168,335,6945
1210 DATA 898,335,199,138,732,33,251,1
80,191,749,72,627,0,49,749,5203
1360 DATA 817,35,214,132,72,749,201,13
,996,690,193,31,902,77,186,5308
1510 DATA 712,401,988,662,725,20,805,3
57,915,518,152,108,416,156,702,7637
1660 DATA 106,875,751,51,10,220,961,21
3,609,249,814,4859
```

•

(Assembly language listing starts next page.)

Coming next issue:

BACTERION!

by

Kyle Peacock

```
        *=  $2000
;
; *** BATTLE IN THE B RING ***
;
;ZERO PAGE VARIABLES
;
PBL0    =   $B0
PBL1    =   $B1
PBL2    =   $B2
PBH2    =   $B3
PBH0    =   $B4
PBH1    =   $B5
XP0     =   $B6
XP1     =   $B7
XP2     =   $B8
XP3     =   $B9
PMVL    =   $BA
PMVH    =   $BB
MBL0    =   $BC
MBL1    =   $BD
MBL2    =   $BE
XM0     =   $BF
XM1     =   $C0
XM3     =   $C1
MBL     =   $C2
MBH     =   $C3
STDIR   =   $C4
MISDIR  =   $C6
XREG    =   $C8
SCRL0   =   $C9
SCRL1   =   $CA
SCRL2   =   $CB
SCRL3   =   $CC
MATH    =   $CD
INTL    =   $CE
INTH    =   $CF
;
;PAGE SIX VARIABLES
;
CHINV   =   $06DB
ADENS   =   $06DC
ASPEED  =   $06DD
SCFLAG  =   $06DE
YMENU   =   $06DF
EXCNTR  =   $06E0
LICNTR  =   $06E2
ROCNTR  =   $06E4
EDCNTR  =   $06E6
TCCNTR  =   $06E8
SSCNTR  =   $06E9
RRCNTR  =   $06EB
ESCNTR  =   $06EC
BOCNTR  =   $06EE
DECNTR  =   $06F0
MXCNTR  =   $06F1
LIPOS   =   $06F2
;
;SYSTEM EQUATES
;
CHBAS   =   $02F4
SDMCTL  =   $022F
SDLSTL  =   $0230
SDLSTH  =   $0231
STICK0  =   $0278
STRIG0  =   $0284
STRIG1  =   $0285
PCOLR0  =   $02C0
COLOR0  =   $02C4
PCOLR3  =   $02C3
PCOLR1  =   $02C1
HPOSP0  =   $D000
HPOSP1  =   $D001
HPOSP2  =   $D002
HPOSP3  =   $D003
HPOSM0  =   $D004
HPOSM1  =   $D005
HPOSM2  =   $D006
HPOSM3  =   $D007
M0PL    =   $D008
M3PL    =   $D00B
P0PL    =   $D00C
CONSOL  =   $D01F
HITCLR  =   $D01E
GRACTL  =   $D01D
CHACTL  =   $D401
HSCROL  =   $D404
PMBASE  =   $D407
WSYNC   =   $D40A
AUDF1   =   $D200
AUDC1   =   $D201
AUDF2   =   $D202
AUDC2   =   $D203
AUDF3   =   $D204
AUDC3   =   $D205
AUDCTL  =   $D208
RANDOM  =   $D20A
NMIEN   =   $D40E
PRIOR   =   $D01B
SKCTL   =   $D20F
SETVBV  =   $E45C
XITVBV  =   $E462
CDTMV3  =   $021C
CDTMV4  =   $021E
VDSLST  =   $0200
CDTMA1  =   $0226
CDTMA2  =   $0228
ATRACT  =   $4D
;
;GAME SET-UP BEGINS
;
        CLD
        LDX #3
COLLP   LDA PFCOL,X ;set
        STA COLOR0,X ;playfield
        LDA MSEL,X  ;colors
        STA ADENS,X
        DEX
        BPL COLLP
        LDA #0
        STA AUDCTL  ;initialize
        LDA #3      ;sounds
        STA SKCTL
        JMP MENU
DLIRTN  PHA
        LDA SCRL1
        STA HSCROL
        LDA #DL1&$FF
        STA VDSLST
        PLA
        RTI
DL1     PHA
        LDA SCRL3
        STA HSCROL
        LDA #DL2&$FF
        STA VDSLST
        PLA
        RTI
DL2     PHA
        LDA #2      ;turns
        STA WSYNC   ;characters
        STA CHACTL  ;right side
        LDA #DL3&$FF ;up bottom
        STA VDSLST  ;screen half
        PLA
        RTI
DL3     PHA
        LDA SCRL1
        STA HSCROL
        LDA #DL4&$FF
        STA VDSLST
        PLA
        RTI
DL4     PHA
        LDA SCRL0
        STA HSCROL
        LDA #DLIRTN&$FF
        STA VDSLST
        PLA
        RTI
;
;SCROLL ROUTINE-TIMER 1-FOR TOPMOST
;AND BOTTOMMOST RINGS
;
SCROLL  LDA #1
        LDY ASPEED
        LDX #0      ;set system
        JSR SETVBV  ;timer 1
        LDA SCRL0
        CMP #9
        BNE DECC9
        RTS
DECC9   DEC SCRL0   ;scroll value
        LDA SCRL0   ;for top and
        BEQ PSCRL   ;bottom rings
        RTS
PSCRL   LDA #8      ;reset scroll
        STA SCRL0   ;value
        LDX #15
        LDA $0605   ;check for
        CMP #106    ;wraparound
        BEQ PFLIP   ;flip
        CLC
        ADC #1      ;flip to next
        JMP HLOOP   ;display byte
PFLIP   LDA #0
HLOOP   STA $0602,X ;store new
        ORA #128    ;low bytes in
        STA $0633,X ;display list
        EOR #128
        DEX
        DEX
        DEX
        BNE HLOOP
        RTS
;
;SCROLL ROUTINE-TIMER 2-FOR TWO
;INNER RINGS AND LIGHTNING
;
SCRLL   LDA #2      ;scroll
        LDX #0      ;routine same
        LDY ASPEED  ;as timer 1
        DEY
        JSR SETVBV
        LDA SCRL0
        CMP #9
        BNE DECCA
        RTS
DECCA   DEC SCRL1
        LDA SCRL1
        BEQ HSCRL
        LDA XP2
        BEQ T2XIT
        DEC XP2     ;change
        LDA XP2     ;lightning
        STA HPOSP2  ;position
        LDX LICNTR  ;value of
        LDY #24     ;light. shape
LILOOP  LDA LIGHT,X ;change light.
        STA (PBL2),Y ;shape
        INX
        DEY
        BPL LILOOP
        STX LICNTR
        CPX #75     ;light. over?
        BNE T2XIT
        LDX #0      ;turn off
        STX LICNTR  ;lightning
        STX HPOSP2
        STX XP2
T2XIT   RTS
HSCRL   LDA #8
        STA SCRL1
        LDX #12
        LDA $0615
        CMP #106
        BEQ PFLIP3
        CLC
        ADC #1
        JMP MLINE
PFLIP3  LDA #0
MLINE   STA $0612,X
        ORA #128
        STA $0626,X
        EOR #128
        DEX
        DEX
        DEX
        BNE MLINE
        LDA XP2
        BNE T2EXIT
        LDA RANDOM
        AND #15
        STA MATH
        CLC
        ADC #2
        CLC
        ADC $061E   ;random gap
        LDY #2      ;asteroid
LOCLI   CMP LIPOS,Y ;position
        BEQ PUTLI
        DEY         ;check for
        BPL LOCLI   ;asteroid
        RTS
PUTLI   LDA MATH
        ASL A       ;calculate
        ASL A       ;initial
        ASL A       ;lightning
        CLC         ;position
        ADC #56
        STA XP2     ;store pos.
        STA HPOSP2
        LDA #200    ;lightning
        STA AUDF1   ;zap sound
        STA AUDC1
        LDA #4
        STA CDTMV4
T2EXIT  RTS
;
;VERTICAL BLANK ROUTINE
;SCROLLS ROCKET, ANIMATES FLAME
;
VBRTN   LDA #192
        STA NMIEN   ;enable dli
        LDA CHINV
        STA CHACTL  ;invert upper
        LDA SCRL0   ;screen half
        STA HSCROL  ;scroll for
        LDA SCRL2   ;first ring
        CMP #16
        BNE ROAR
        JMP XITVBV
ROAR    LDA RRCNTR  ;time to inc.
        BEQ FLAMCK  ;volume of
        CMP #136    ;rocket roar?
        BEQ FLAMCK
        INC RRCNTR
        LDA RRCNTR
        STA AUDC2
FLAMCK  INC SCRL2
        LDA SCRL2   ;time to
        AND #1      ;scroll?
        BEQ GFLAM
        JMP XITVBV
GFLAM   DEC SCRL3
        LDA SCRL2
        AND #15
        STA SCRL2
        LSR A
        TAX         ;get flame
```

```
         LDA FLTAB,X ;shape
         STA $1024,X ;display
         LDA XP3
         BEQ OUTCK
         DEC XP3     ;change hot
         LDA XP3     ;tail pos.
         STA HPOSP3
OUTCK    LDA SCRL3
         BEQ SCRLH
         JMP XITVBV
SCRLH    LDA #8
         STA SCRL3
         LDA $0622   ;rocket on
         CMP #11     ;screen?
         BNE ROOFF
         LDX #224    ;yes put hot
         STX XP3     ;tail
         STX AUDF2   ;start sound
         LDX #129
         STX AUDC2
         STX RRCNTR
ROOFF    CMP #36     ;rocket off
         BNE CKROM   ;screen?
         LDX #0      ;turn off
         STX AUDF2   ;rocket roar
         STX AUDC2
         STX RRCNTR
CKROM    LDX XM3     ;missile in
         CPX #0      ;use?
         BNE FLIPCK  ;yes go on
         CLC         ;no
         CMP #13     ;rocket on
         BCC FLIPCK  ;screen?
         CLC
         CMP #30
         BCS FLIPCK
         SEC
         SBC #13     ;calculate
         ASL A       ;initial
         ASL A       ;missile pos.
         ASL A
         STA MATH
         LDA #204
         SEC
         SBC MATH
         STA MATH    ;store pos.
         LDX #0
ROMLOOP  CLC         ;saucer in
         LDA PBL0,X  ;gap?
         CMP #107
         BCC TRYAG
         CLC
         CMP #130
         BCS TRYAG
         CLC
         LDA XP0,X   ;in front of
         CMP MATH    ;rocket?
         BCC STM3    ;yes
TRYAG    INX
         CPX #2
         BNE ROMLOOP
         JMP FLIPCK
STM3     LDA MATH    ;fire
         STA XM3     ;missiles
         STA HPOSM3
         LDA #38     ;missile
         STA AUDF1   ;sound
         LDA #142
         STA AUDC1
         LDA #5
         STA CDTMV4
FLIPCK   LDA $0622
         CMP #63
         BEQ PFLIP5
         CLC
         ADC #1
         JMP MLINE3
PFLIP5   LDA #0
MLINE3   STA $0622
         STA $0625
VBOUT    JMP XITVBV
;
;MAIN PROGRAM BEGINS HERE
;
PROG     LDX #31     ;zero out
         LDA #0      ;zero page+
CLZLOOP  STA PBL0,X  ;page 6
         STA EXCNTR,X ;variables
         DEX
         BPL CLZLOOP
         LDA #9      ;no scroll
         STA SCRL0   ;until ready
         LDA #16     ;to play
         STA SCRL2
         LDA #4
         STA CHINV
         LDA #0
         TAX
         TAY
         LDA #24
         STA PMBASE  ;pm graphics
         LDA #27     ;location
         STA MBH     ;missiles
         LDA #28
         STA PBH0    ;player 0
         LDA #29
         STA PBH1    ;player 1
         LDA #30
         STA PBH2    ;player 2
         LDA #224
         STA INTH
         LDA #18     ;character
         STA PMVH    ;set on
         STA CHBAS   ;page 18
         LDA #0
         STA PMVL
         STA INTL
         TAX
         TAY
DWNLD    LDA (INTL),Y ;download rom
         STA (PMVL),Y ;characters
         INY
         BNE DWNLD
         INC PMVH
         INC INTH
         INX
         CPX #2
         BNE DWNLD
         DEC PMVH
         DEC PMVH
         LDY #0
         LDA #8
         STA PMVL
CHLOOP   LDA CHTAB,Y ;load data for
         STA (PMVL),Y ;asteroid
         INY          ;characters
         CPY #120
         BNE CHLOOP
         LDX #0
         LDY #208
         STX PMVL
C2LOOP   LDA C2TAB,X ;load data for
         STA (PMVL),Y ;rocket
         INX          ;characters
         CPX #56
         BEQ RESET
         INY
         BNE C2LOOP
         INC PMVH
         JMP C2LOOP
RESET    LDX #77
         LDY #0
         STY SDMCTL
DLOOP    LDA GDLIST,X ;load game
         STA $0600,X ;display
         DEX          ;list onto
         BPL DLOOP    ;page six
         LDA #6       ;tell comp.
         STY SDLSTL   ;where dlist
         STA SDLSTH   ;is
         LDA $0606
         STA PMVH
         STY PMVL
         TYA
         TAX
CLOOP    STA (PMVL),Y ;clear
         INY          ;display
         BNE CLOOP    ;area
         INC PMVH
         INX
         CPX #11
         BNE CLOOP
         LDX #0
         LDA $0606
         STA PMVH
         LDA ADENS
         STA INTH
         STX PMVL
RANDC    LDA RANDOM  ;color for
         AND #3      ;asteroid
         TAY         ;character
         LDA COLOR,Y
         STA INTL
RANDP    CLC
         LDY RANDOM  ;random
         CPY #107    ;position
         BCS RANDP
         LDA (PMVL),Y
         CMP #0      ;occupied?
         BNE RANDP   ;yes go back
RANDA    LDA RANDOM  ;random
         AND #15     ;asteroid
         BEQ RANDA   ;character
         ORA INTL
         STA (PMVL),Y ;store in
         INX          ;display
         CPX INTH     ;line done?
         BNE RANDC
         LDX #0
         CLC
         LDA PMVL
         ADC #128    ;do next line
         STA PMVL
         BCC ASKIP
         INC PMVH
ASKIP    LDA PMVH
         CMP $061F
         BNE AENDCK
         LDY INTH
         DEY
         DEY
         DEY
         STY INTH
AENDCK   CMP $0626   ;all lines
         BNE RANDC   ;done?
         LDA $061F
         STA PMVH
RANDC2   LDA RANDOM  ;same as
         AND #3      ;above but
         TAY         ;for
         LDA COLOR,Y ;asteroids
         STA INTL    ;across gap
         LDA RANDOM  ;from each
         AND #3      ;other for
         TAY         ;lightning
         LDA COLOR,Y
         STA INTH
RANDP2   CLC
         LDA RANDOM
         BEQ RANDP2
         CMP #105
         BCS RANDP2
         STA PMVL
         STA LIPOS,X
         LDY #0
         LDA (PMVL),Y
         BNE RANDP2
RANDA2   LDA RANDOM
         AND #15
         BEQ RANDA2
         ORA INTL
         STA (PMVL),Y
RANDA3   LDA RANDOM
         AND #15
         BEQ RANDA3
         ORA INTH
         LDY #128
         STA (PMVL),Y
         INX
         CPX #3
         BNE RANDC2
         LDA #0
         LDX #18
CLRAST   STA $0700,X ;clear lines
         STA $0780,X ;saucer start
         DEX         ;positions
         BPL CLRAST
         LDY #20
         LDA $0606
         STA PMVH
         STA INTH
         LDA #107
         STA INTL
         INX
         STX PMVL
WLOOP    LDA (PMVL),Y ;wraparound
         STA (INTL),Y ;display
         DEY          ;area for
         BPL WLOOP    ;continuous
         LDY #20      ;scrolling
         INX
         LDA PMVL
         CLC
         ADC #128
         STA PMVL
         BCC WSKIP1
         INC PMVH
WSKIP1   LDA INTL
         CLC
         ADC #128
         STA INTL
         BCC WSKIP2
         INC INTH
WSKIP2   CPX #18     ;finished?
         BNE WLOOP   ;no go back
         LDY #3
ROLOOP   LDA ROTAB,Y ;load rocket
         STA $1020,Y ;data into
         DEY         ;display area
         BPL ROLOOP
         LDA #16
         STA $0664   ;initialize
         STA $066E   ;scores
         LDA #0
         TAX
         STA $0663
         STA $066D
         LDA #24
         STA PMVH
         TXA
         STA PMVL
         TAY
CLRPMG   STA (PMVL),Y ;clear pm
         INY          ;graphics
         BNE CLRPMG   ;area
         INC PMVH
         INX
         CPX #8
```

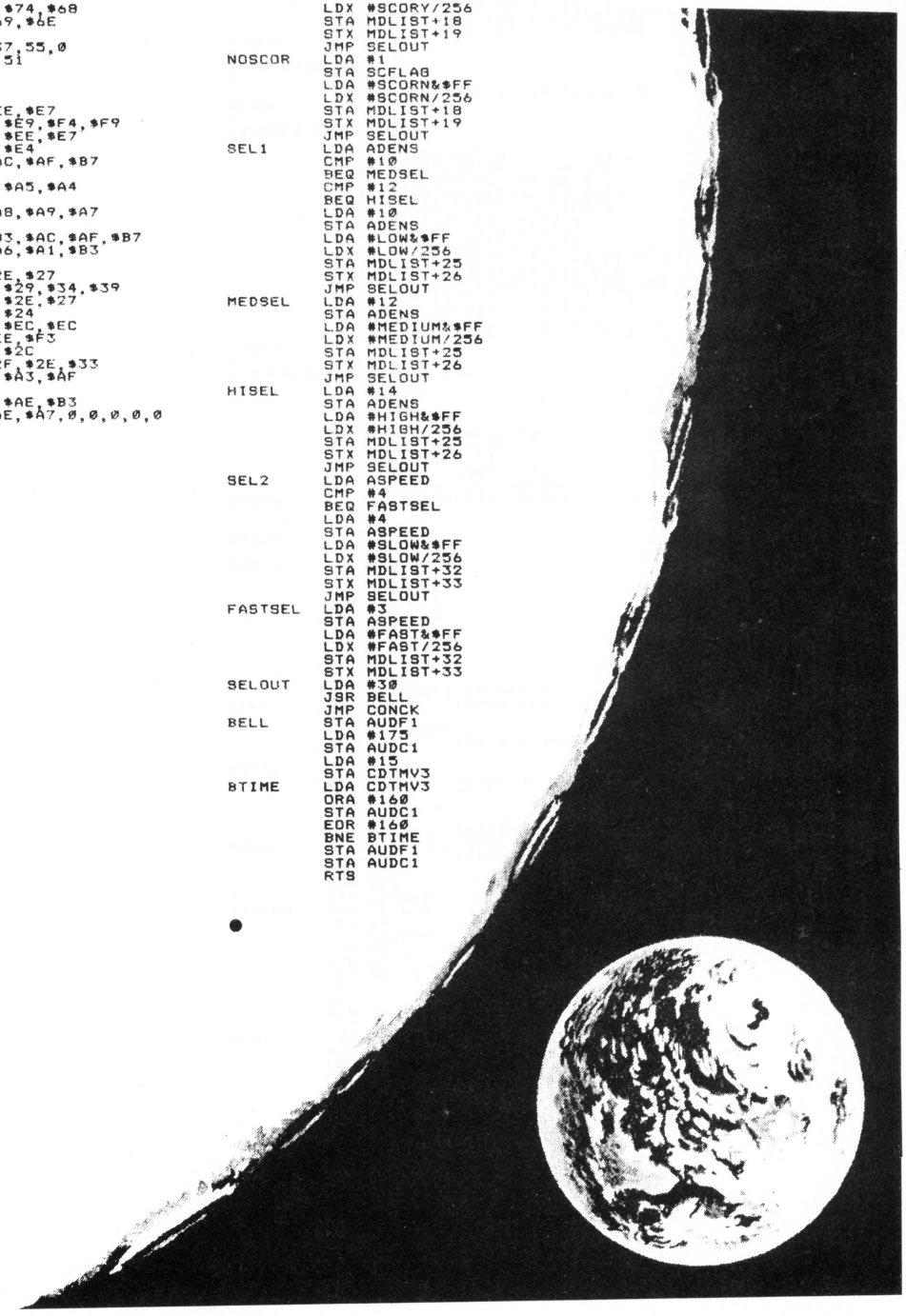
```
        BNE CLRPMG
        LDX #5
        LDA #0
ZLOOP   STA HPOSP2,X ;initialize
        DEX           ;player/
        BPL ZLOOP     ;missile
        LDA #108
        STA PBL2
        LDA #3        ;set up
        STA GRACTL    ;graphics
        LDA #62       ;dma
        STA SDMCTL
        STA HITCLR    ;clr collis.
        LDA #120      ;initialize
        STA HPOSP1    ;saucer
        STA XP1       ;positions
        STA HPOSP0
        STA XP0
        LDA #196
        STA PBL1
        LDA #33
        STA PBL0
        STA PMVL
        LDA PBH0
        STA PMVH
        LDA PBL1
        STA INTL
        LDA PBH1
        STA INTH
        LDY #7
LDPLYRS LDA PLSHP,Y ;load
        STA (PMVL),Y ;player
        STA (INTL),Y ;data into
        DEY          ;pm area
        BPL LDPLYRS
        INC INTH
        INC INTH
        LDY #116
        LDA #0
        STA INTL
        LDA #1
LDTAIL  STA (INTL),Y ;load hot
        INY          ;rocket
        CPY #124     ;tail
        BNE LDTAIL
        LDY #112
        LDA #192
        STA (MBL),Y
        LDY #127
        STA (MBL),Y
        LDX #3
PCLOOP  LDA PCOL,X   ;set playr
        STA PCOLR0,X ;colors
        DEX
        BPL PCLOOP
        LDA #8       ;initialize
        STA HSCROL   ;scroll
        STA SCRL1    ;settings
        STA SCRL3
        STA CONSOL
        STA STDIR+1
        LDA #9
        STA STDIR
;
;SET SYSTEM TIMERS,
;VERT. BLANK AND DLI ROUTINES
;
        LDA #SCROLL&$FF ;timer 1
        STA CDTMA1
        LDA #SCROLL/256
        STA CDTMA1+1
        LDA #1
        LDX #0
        LDY #4
        JSR SETVBV
        LDA #SCRLL&$FF ;timer 2
        STA CDTMA2
        LDA #SCRLL/256
        STA CDTMA2+1
        LDA #2
        LDX #0
        LDY #3
        JSR SETVBV
        LDA #7
        LDX #VBRTN/256 ;vertical
        LDY #VBRTN&$FF ;blank
        JSR SETVBV
        LDA #DLIRTN/256
        STA VDSLST+1
        LDA #DLIRTN&$FF
        STA VDSLST
        LDA #192     ;dli
        STA NMIEN
        LDA #1       ;set pmg
        STA PRIOR    ;priority
STLOOP  LDA STRIG0   ;check
        BNE SB2CK    ;triggers
        JMP GETDEL   ;for game
SB2CK   LDA STRIG1   ;start
        BNE STLOOP
GETDEL  LDA #15
        STA CDTMV3
DSTLOOP LDA CDTMV3
        BNE DSTLOOP
        STA SCRL2    ;allow
        LDA #8       ;scrolling
        STA SCRL0
MLOOP   LDA #1       ;game prog
        STA CDTMV3   ;begins
        INC XREG     ;move timer
        LDA XREG     ;playr index
        AND #1
        TAX
        STA XREG
        LDA XP0,X    ;check for
        BNE TAILCK   ;dead player
        JMP INCM
TAILCK  LDA SCRL2    ;check for
        CMP #16      ;missile
        BNE EXPCK    ;collision
        INC TCONTR   ;with rocket
        LDA TCONTR   ;tail
        AND #31      ;time to
        STA TCONTR   ;cool tail?
        BNE EXPCK    ;no go on
        LDA PCOLR3
        CMP #148
        BEQ EXPCK
        DEC PCOLR3   ;cool tail
EXPCK   LDA EXCNTR,X ;check count
        BEQ BOUNCK   ;for player
        INC EDCNTR,X ;explosion
        LDA EDCNTR,X
        AND #3       ;time to
        STA EDCNTR,X ;change exp?
        BNE EXLCK    ;no go on
        LDY SNDX,X   ;change sound
        LDA ESCNTR,X ;get sound
        CMP #128     ;finished?
        BEQ EXSNOFF  ;yes off
        DEC ESCNTR,X ;no make
        LDA ESCNTR,X ;changes
        STA AUDC3,Y
        JMP EXLCK
EXSNOFF LDA #0       ;turn sound
        STA AUDF3,Y ;off
        STA AUDC3,Y
        STA ESCNTR,X
EXLCK   LDA PCOLR0,X ;change
        CMP #159     ;color
        BEQ BLINC
        INC PCOLR0,X
        INC PCOLR0,X
        INC PCOLR0,X
        JMP INCM
BLINC   LDA EDCNTR,X
        AND #1
        BEQ BLJUMP
        JMP INCM
BLJUMP  JMP BLPL
BOUNCK  LDA BOCNTR,X ;check for
        BEQ RMCK     ;bounce
        JMP REBOUND
RMCK    LDA M3PL     ;check for
        BEQ PLPLCK   ;collision
        LDY #0       ;with
        STY XM3      ;rocket's
        STY HPOSM3   ;missiles
        STY HITCLR
        CMP #4
        BEQ PLPLCK
        TAX
        DEX
        STX MBL
        LDY #6
        JSR MOVPLYR
        LDX MBL
        JSR EXPLO
        LDX XREG
PLPLCK  LDA P0PL,X   ;check for
        BEQ MPFCK    ;player/
        CMP #4       ;player
        BNE PL8CK    ;collisions
        JMP PBLPL
PL8CK   CMP #8       ;hit hot
        BNE DOTWO    ;tail?
        LDA PCOLR3
        CMP #148
        BEQ YOTHER
        JMP PBLPL    ;yes kill
YOTHER  LDY OTHER,X ;no tail
        LDA XP0,Y    ;cool game
        STA HITCLR   ;over
        BNE IJUMP
        JMP ENDIT
IJUMP   JMP INCM
DOTWO   JMP BLBOTH  ;kill both
MPFCK   LDA HPOSP0,X ;check for
        BEQ MPLCK    ;missile/
        JSR MISEXP   ;playfield
        JSR EXSOUND ;collisions
        JSR TOM      ;missile off
MPLCK   LDA M0PL,X   ;check for
        BEQ PLPFCK   ;missile/
        CMP #4       ;player
        BNE M8CK     ;collisions
        JSR TOM
        JMP PLPFCK
M8CK    CMP #8       ;hit tail?
        BNE PLEX     ;no go on
        JSR TOM      ;yes stop
        LDA #16      ;rocket
        STA SCRL2
        LDA #0
        STA $1024
        STA AUDF2
        STA AUDC2
        JMP PLPFCK
PLEX    LDY MISDIR,X ;hit saucer
        TAX
        DEX
        LDA EXCNTR,X ;dead yet?
        BEQ MSCOR    ;no score it
        JMP INCM     ;yes
MSCOR   JSR MOVPLYR ;move plyr
        TXA
        LSR A
        TAX
        JSR EXPLO    ;add score
        LDX XREG
        JSR MISEXP
        JSR TOM      ;missile off
PLPFCK  LDA HPOSM0,X ;check for
        BEQ STRCK    ;player/
        STA HITCLR   ;playfield
        JSR EXSOUND ;collisions
        LDA SCFLAG   ;scoring?
        BNE REBOUND ;no go on
        JSR EXPLO    ;yes score
REBOUND INC BOCNTR,X ;bounce
        LDA BOCNTR,X ;plyr off
        CMP #4       ;rocks?
        BNE RUBBER   ;yes
        LDA #0       ;no end
        STA BOCNTR,X ;bounce
RUBBER  LDA STDIR,X ;bounce plyr
        TAY
        LDA BOUNCE,Y
        CMP #6
        BNE DOTAY
        CLC
        LDA PBL0,X
        CMP #117
        LDA #4
        BCS DOTAY
        LDA #5
DOTAY   TAY
        JSR MOVPLYR
        JMP INCM
STRCK   LDA STRIG0,X ;check
        BNE STIK     ;triggers
        STA ATRACT   ;no attract
        LDA XM0,X    ;missile
        BNE STIK     ;already in
        JMP MISL     ;use?
STIK    LDA STICK0,X ;check
        CMP #15      ;joysticks
        BNE GSTIK    ;no move
        JSR ROTOR
        JMP INCM
GSTIK   SEC          ;yes
        SBC #5       ;get
        TAY          ;movement
        STA STDIR,X ;index
        JSR MOVPLYR
        JMP INCM
MOVPLYR LDA XP0,X
        CLC
        ADC PXDIR,Y ;check limits
        CMP #193
        BEQ RAISE
        CMP #47
        BEQ RAISE
STORX   STA HPOSP0,X ;player
        STA XP0,X    ;horiz. move
RAISE   LDA PBH0,X
        STA PMVH
        LDA PBL0,X
        CLC
        ADC PYDIR,Y
        CMP #197
        BEQ ROTOR
        CMP #34
        BEQ ROTOR
        STA PMVL
        STA PBL0,X
        LDY #7
PLOOP   LDA PLSHP,Y ;player
        STA (PMVL),Y ;vert. move
        DEY
        BPL PLOOP
        INC ROCNTR,X
        LDA ROCNTR,X
        AND #7
        STA ROCNTR,X
        TAY
        LDA ROTATE,Y
```

```
        LDY #4
        STA (PMVL),Y ;rotate
        LDA SSCNTR,X ;saucer
        BEQ DOROT    ;center
        RTS
DOROT   LDA ROCNTR,X
        AND #1
        TAY
        LDA SNDX,X
        TAX
        LDA MSAUSND,Y ;moving
        STA AUDF3,X ;saucer
        LDA #165    ;sound
        STA AUDC3,X
        RTS
ROTOR   LDA PBL0,X  ;slower
        STA PMVL    ;stationary
        LDA PBH0,X  ;rotate
        STA PMVH
        INC ROCNTR,X
        LDA ROCNTR,X
        AND #15
        STA ROCNTR,X
        LSR A
        TAY
        LDA ROTATE,Y
        LDY #4
        STA (PMVL),Y
        LDA SSCNTR,X
        BEQ DOROT2
        RTS
DOROT2  LDA ROCNTR,X
        AND #3
        LSR A
        TAY
        LDA SNDX,X
        TAX
        LDA SSAUSND,Y
        STA AUDF3,X ;stationary
        LDA #165    ;sound
        STA AUDC3,X
        RTS
INCM    LDA XM0     ;check
        BEQ CKM1    ;missile 0
        LDX #0      ;movement
        JSR GDIR
CKM1    LDA XM1     ;check
        BEQ CKM3    ;missile 1
        LDX #1      ;movement
        JSR GDIR
CKM3    LDA XM3     ;check
        BEQ NEXIT   ;missile 2
        DEC XM3     ;movement
        LDA XM3
        STA HPOSM3
NEXIT   LDA CDTMV4  ;check sound
        BNE BUTCK   ;timer
        STA AUDF1
        STA AUDC1
BUTCK   LDA CONSOL  ;check
        CMP #7      ;console
        BEQ SHOTSND
        JMP ENDIT
SHOTSND LDA SSCNTR  ;check shot
        BEQ SHOTSND2 ;sound
        LDX #0      ;counter
        JSR INCSHOT
SHOTSND2 LDA SSCNTR+1
        BEQ TOMEX
        LDX #1
        JSR INCSHOT
TOMEX   LDA MBL2    ;check for
        BEQ EXIT    ;end of
        INC MXCNTR  ;missile
        LDA MXCNTR  ;explosion
        AND #3
        STA MXCNTR
        BNE EXIT
        LDA MBL2
        STA MBL
        LDA #0
        STA HPOSM2
        STA MBL2
        LDY #4
TOMLOOP LDA (MBL),Y
        EOR MXSHP,Y
        STA (MBL),Y
        DEY
        BPL TOMLOOP
EXIT    LDA CDTMV3  ;check
        BNE EXIT    ;move timer
        JMP MLOOP   ;start over
INCSHOT INC SSCNTR,X ;change shot
        INC SSCNTR,X ;sound
        LDA SSCNTR,X
        CMP #48
        BEQ ENDSHOT
        LDY SNDX,X
        STA AUDF3,Y
        RTS
ENDSHOT LDA #0      ;turn off
        STA SSCNTR,X ;shot sound
        RTS

MISEXP  LDA MBL2    ;check miss.
        BEQ DOEXP   ;explosion
        RTS         ;in use
DOEXP   LDA XM0,X   ;load
        STA HPOSM2  ;missile
        LDA MBL0,X  ;explosion
        SEC         ;data
        SBC #2
        STA MBL2
        STA MBL
        LDY #4
MIXLOOP LDA (MBL),Y
        ORA MXSHP,Y
        STA (MBL),Y
        DEY
        BPL MIXLOOP
        RTS
MISL    CLC         ;determine
        LDA XP0     ;missile
        CMP XP1     ;direction
        LDA MDIR1,X
        BCC GETDIR
        LDA MDIR2,X
GETDIR  STA MISDIR,X
        LDY SNDX,X
        LDA #8
        STA AUDF3,Y
        STA SSCNTR,X
        LDA #139
        STA AUDC3,Y
        LDY MISDIR,X
        LDA XP0,X   ;initial
        CLC         ;missile
        ADC MSPOS,Y ;position
        STA XM0,X
        LDA PBL0,X
        CLC
        ADC #5
        STA MBL0,X
        STA MBL
        LDY #0
        LDA (MBL),Y ;load
        ORA MSSHP,X ;missile
        STA (MBL),Y ;data
        JMP STIK
EXPLO   JSR EXSOUND
        LDY SCORE,X
        LDA $0664,Y ;get score
        CLC
        ADC #1      ;add one
        CMP #26     ;10 yet?
        BEQ NEXP    ;yes kill
        STA $0664,Y ;no store
        RTS
NEXP    LDA #16
        STA $0664,Y
        LDA #17
        STA $0663,Y
        PLA         ;pull return
        PLA         ;address
PBLPL   JSR EXSOUND
        LDY SNDX,X
        LDA #200    ;start
        STA AUDF3,Y ;explosion
        LDA #143    ;sound
        STA AUDC3,Y
        STA ESCNTR,X
        LDA #144    ;change
        STA PCOLR0,X ;color
BLPL    LDA PBL0,X
        STA PMVL
        LDA PBH0,X
        STA PMVH
        STX MBL
        LDA EXCNTR,X
        TAX
        LDY #7
BLO1    LDA EXSHP,X ;load
        STA (PMVL),Y ;explosion
        INX         ;shape
        DEY
        BPL BLO1
        CPX #64     ;finished?
        BEQ EXOFF
        TXA
        LDX MBL
        STA EXCNTR,X ;store data
        JMP INCM    ;number
EXOFF   LDA #0      ;turn off
        LDX XREG    ;explosion
        STA EXCNTR,X
        STA HPOSP0,X ;player off
        STA XP0,X   ;screen
        STA PBL0,X
        STA HITCLR
        LDY SNDX,X
        STA AUDF3,Y
        STA AUDC3,Y
        INC DECNTR
        LDA DECNTR
        CMP #2      ;both dead?
        BNE GOBACK  ;no go back
        JMP ENDIT   ;game over

GOBACK  JMP INCM
EXSOUND LDA #200    ;collision
        STA AUDF1   ;sound
        LDA #142
        STA AUDC1
TIMER   LDA #5      ;set sound
        STA CDTMV4  ;timer
        RTS
BLBOTH  JSR EXSOUND ;saucers
        LDX #0      ;collided
        LDY #0      ;kill both
        LDA #138
        STA PCOLR0
        STA PCOLR1
        LDA PBL1
        STA PMVL
        LDA PBH1
        STA PMVH
        LDA PBH0
        STA PBL1
BLO3    LDA EXSHP,X
        STA (PMVL),Y
        STA (PBL0),Y
        INX
        INY
        CPY #8
        BNE BLO3
        LDA #2
        STA CDTMV4
        LDY #0
TIMCKB  LDA CDTMV4
        BNE TIMCKB
        CPX #64
        BNE BLO3
        JMP ENDIT   ;game over
GDIR    LDY MISDIR,X ;get
        LDA XM0,X   ;direction
        CLC
        ADC PXDIR,Y
        CMP #220    ;check
        BEQ TOM     ;limits
MXLCK   CMP #40
        BEQ TOM
        STA XM0,X   ;move missile
        STA HPOSM0,X
        RTS
TOM     LDA #0      ;turn off
        STA HPOSM0,X ;missile
        STA XM0,X
        STA HITCLR
        TAY
        LDA MBL0,X
        STA MBL
        LDA (MBL),Y
        EOR MSSHP,X
        STA (MBL),Y
        RTS
ENDIT   LDA #30
        STA CDTMV3
ENTCK   LDA CDTMV3
        BNE ENTCK
        LDY #7
ENDLP   STA HPOSP0,Y ;all plyrs
        STA AUDF1,Y ;off screen
        DEY         ;sound off
        BPL ENDLP
        LDA #16     ;stop
        STA SCRL2   ;scrolls
        LDA #9
        STA SCRL0
        JMP MENU
;
;ASTEROID CHARACTER DATA
;
CHTAB
        .BYTE 0,24,56,127,126,24,60,32
        .BYTE 0,28,126,127,60,24,0
        .BYTE 0,0,16,60,120,8,0,0
        .BYTE 0,0,24,126,62,124,100,0
        .BYTE 24,62,124,60,24,126,60,120
        .BYTE 0,66,124,56,60,126,6,0
        .BYTE 28,60,30,60,126,126,56,0
        .BYTE 0,0,16,56,28,0,0,0
        .BYTE 0,0,24,32,0,0,0,0
        .BYTE 0,0,56,126,24,48,0,0
        .BYTE 0,0,0,24,60,126,120,0
        .BYTE 0,60,62,30,124,56,32,0
        .BYTE 0,0,0,0,63,110,52,0
        .BYTE 0,24,120,60,62,28,0,0
        .BYTE 0,124,62,60,28,62,120,0
;
;SAUCER SHAPE
;
PLSHP
        .BYTE 0,16,56,254,254,254,56,0
;
;EXPLOSION SHAPES
;
EXSHP
        .BYTE 0,8,64,24,254,170,254,48
        .BYTE 4,128,36,128,126,170,253,16
        .BYTE 0,36,0,82,44,41,60,64
        .BYTE 36,0,145,8,66,42,74,16
```

```
        .BYTE 34,145,0,16,129,82,0,146
        .BYTE 137,32,128,1,64,2,128,81
        .BYTE 64,1,0,128,0,0,65,128
        .BYTE 0,0,0,0,0,0,0,0
PLINE   .BYTE 0,0,$30,$2C,$39,$32
        .BYTE 0,$11,0,0,0,0,$30,$2C,$39
        .BYTE $32,0,$12,0,0
;
;MOVEMENT INDEXES
;
PXDIR   .BYTE 1,1,1,0,255,255,255,0,0,0
PYDIR   .BYTE 1,255,0,0,1,255,0,0,1,255
;
;BOUNCE MOVEMENT INDEXES
;
BOUNCE  .BYTE 1,0,6,0,5,4,2,0,9,8
MSPOS   .BYTE 0,0,9,0,0,0,254
COLOR   .BYTE 0,64,128,192
;
;ROCKET CHARACTER DATA
;
C2TAB   .BYTE 255,63,31,0,0,0,0,0
        .BYTE 255,255,255,0,0,0,0,0
        .BYTE 255,255,255,31,15,7,3,7
        .BYTE 254,254,222,2,0,0,0,0
        .BYTE 252,248,240,224,0,0,0,0
        .BYTE 254,252,248,240,0,0,0,0
        .BYTE 248,240,224,192,0,0,0,0
;
;MISSILE MOVEMENT INDEXES
;
MDIR1   .BYTE 2,6
MDIR2   .BYTE 6,2
ROTAB   .BYTE 154,27,28,221
FLTAB   .BYTE 159,158,160,0,0,0,0,0
;
;LIGHTNING SHAPE DATA
;
LIGHT   .BYTE 16,8,16,24,8,16,8,16,8
        .BYTE 8,16,8,16,16,16,24,8
        .BYTE 16,8,8,4,8,16,8,16
        .BYTE 8,16,16,8,16,8,16,16,24
        .BYTE 8,16,8,16,8,8,16,8
        .BYTE 16,8,8,24,16,16,8,8
        .BYTE 4,16,8,8,16,8,16,8,4
        .BYTE 8,16,32,32,24,8,16,12
        .BYTE 4,8,16,8,16,16,8,8
SCORE   .BYTE 0,10
OTHER   .BYTE 1,0
;
;ROTATING SAUCER CENTER DATA
;
ROTATE  .BYTE 126,190,222,238,246,250,252,254
SNDX    .BYTE 0,2
MSAUSND .BYTE 160,170
SSAUSND .BYTE 180,190
MSSHP   .BYTE 3,12
MXSHP   .BYTE 32,16,48,48,32,16
PCOL    .BYTE 202,70,158,158
MSEL    .BYTE 10,4,0,0
PFCOL   .BYTE 40,37,68,121
;
;DISPLAY LIST INTERRUPT ALLOWS
;RINGS TO SCROLL INDIVIDUALLY
;
;GAME DISPLAY LIST
;
GDLIST  .BYTE 112,112,112,32,86,0,7
        .BYTE 86,0,8,86,0,9,86,0,10
        .BYTE 86,0,11,128,86,0,12,86,0,13
        .BYTE 86,0,14,86,0,15,176
        .BYTE 214,0,16,86,0,16,176
        .BYTE 86,128,15,86,128,14
        .BYTE 86,128,13,86,128,12,128
        .BYTE 86,128,11,86,128,10
        .BYTE 86,128,9,86,128,8
        .BYTE 86,128,7,70
        .WORD PLINE
        .BYTE 70,96,6,32,65,0,6
;
;MENU DISPLAY LIST
;
MDLIST  .BYTE 112,112,112,112,71
        .WORD TITL
        .BYTE 7,112,70
        .WORD AUTH
        .BYTE 112,112,71
        .WORD COLLISY
        .BYTE 71
        .WORD SCORY
        .BYTE 112,71
        .WORD RINGD
        .BYTE 71
        .WORD LOW
        .BYTE 112,71
        .WORD RINGS
        .BYTE 71
        .WORD SLOW
        .BYTE 112,65
        .WORD MDLIST
TITL    .BYTE 0,0,0,0,0,$62,$61,$74
        .BYTE $74,$6C,$65,0,$69,$6E,0,0
        .BYTE 0,0,0,0,0,0,0,0,0,$74,$68
        .BYTE $65,0,$62,0,$72,$69,$6E
        .BYTE $67,0,0
AUTH    .BYTE 0,0,0,34,57,0,44,37,55,0
        .BYTE 52,40,47,45,41,52,51
;
;MENU SELECTIONS
;
RINGD   .BYTE 0,0,0,0,$F2,$E9,$EE,$E7
        .BYTE 0,$E4,$E5,$EE,$F3,$E9,$F4,$F9
RINGS   .BYTE 0,0,0,0,0,$F2,$E9,$EE,$E7
        .BYTE 0,$F3,$F0,$E5,$E5,$E4
LOW     .BYTE 0,0,0,0,0,0,0,0,$AC,$AF,$B7
        .BYTE 0,0
MEDIUM  .BYTE 0,0,0,0,0,0,0,0,$AD,$A5,$A4
        .BYTE $A9,$B5,$AD
HIGH    .BYTE 0,0,0,0,0,0,0,0,0,$A8,$A9,$A7
        .BYTE $A8,0
SLOW    .BYTE 0,0,0,0,0,0,0,0,0,$B3,$AC,$AF,$B7
FAST    .BYTE 0,0,0,0,0,0,0,0,0,$A6,$A1,$B3
        .BYTE $B4,0,0,0,0
RINGDY  .BYTE 0,0,0,0,$32,$29,$2E,$27
        .BYTE 0,$24,$25,$2E,$33,$29,$34,$39
RINGSY  .BYTE 0,0,0,0,0,$32,$29,$2E,$27
        .BYTE 0,$33,$30,$25,$25,$24
COLLIS  .BYTE 0,0,0,0,0,$E3,$EF,$EC,$EC
        .BYTE $E9,$F3,$E9,$EF,$EE,$F3
COLLISY .BYTE 0,0,0,0,0,$23,$2F,$2C
        .BYTE $2C,$29,$33,$29,$2F,$2E,$33
SCORY   .BYTE 0,0,0,0,0,0,0,$B3,$A3,$AF
        .BYTE $B2,$A9,$AE,$A7,0
SCORN   .BYTE 0,0,0,0,0,$AE,$AF,$AE,$B3
        .BYTE $A3,$AF,$B2,$A9,$AE,$A7,0,0,0,0,0
MENU    LDA #0
        STA SDMCTL
        LDY YMENU
        LDA #224
        STA CHBAS
        LDA #2
        STA CHINV
        LDA #MDLIST&$FF
        LDX #MDLIST/256
        STA SDLSTL
        STX SDLSTH
        LDA #62
        STA SDMCTL
CONCK   LDA CONSOL
        CMP #6
        BNE OPTCK
        STY YMENU
        LDA #20
        JSR BELL
        JMP PROG
OPTCK   CMP #3
        BNE SELCK
        CPY #1
        BEQ OPT1
        CPY #2
        BEQ OPT2
        LDA #COLLIS&$FF
        LDX #COLLIS/256
        STA MDLIST+15
        STX MDLIST+16
        LDA #RINGDY&$FF
        LDX #RINGDY/256
        STA MDLIST+22
        STX MDLIST+23
        JMP OPOUT
OPT1    LDA #RINGD&$FF
        LDX #RINGD/256
        STA MDLIST+22
        STX MDLIST+23
        LDA #RINGSY&$FF
        LDX #RINGSY/256
        STA MDLIST+29
        STX MDLIST+30
        JMP OPOUT
OPT2    LDA #RINGS&$FF
        LDX #RINGS/256
        STA MDLIST+29
        STX MDLIST+30
        LDA #COLLISY&$FF
        LDX #COLLISY/256
        STA MDLIST+15
        STX MDLIST+16
OPOUT   INY
        CPY #3
        BNE JBELL
        LDY #0
JBELL   LDA #40
        JSR BELL
        JMP CONCK
SELCK   CMP #5
        BNE CONCK
        CPY #1
        BEQ SEL1
        CPY #2
        BEQ SEL2
        LDA SCFLAG
        BEQ NOSCOR
        LDA #0
        STA SCFLAG
        LDA #SCORY&$FF
        LDX #SCORY/256
        STA MDLIST+18
        STX MDLIST+19
        JMP SELOUT
NOSCOR  LDA #1
        STA SCFLAG
        LDA #SCORN&$FF
        LDX #SCORN/256
        STA MDLIST+18
        STX MDLIST+19
        JMP SELOUT
SEL1    LDA ADENS
        CMP #10
        BEQ MEDSEL
        CMP #12
        BEQ HISEL
        LDA #10
        STA ADENS
        LDA #LOW&$FF
        LDX #LOW/256
        STA MDLIST+25
        STX MDLIST+26
        JMP SELOUT
MEDSEL  LDA #12
        STA ADENS
        LDA #MEDIUM&$FF
        LDX #MEDIUM/256
        STA MDLIST+25
        STX MDLIST+26
        JMP SELOUT
HISEL   LDA #14
        STA ADENS
        LDA #HIGH&$FF
        LDX #HIGH/256
        STA MDLIST+25
        STX MDLIST+26
        JMP SELOUT
SEL2    LDA ASPEED
        CMP #4
        BEQ FASTSEL
        LDA #4
        STA ASPEED
        LDA #SLOW&$FF
        LDX #SLOW/256
        STA MDLIST+32
        STX MDLIST+33
        JMP SELOUT
FASTSEL LDA #3
        STA ASPEED
        LDA #FAST&$FF
        LDX #FAST/256
        STA MDLIST+32
        STX MDLIST+33
SELOUT  LDA #30
        JSR BELL
        JMP CONCK
BELL    STA AUDF1
        LDA #175
        STA AUDC1
        LDA #15
        STA CDTMV3
BTIME   LDA CDTMV3
        ORA #160
        STA AUDC1
        EOR #160
        BNE BTIME
        STA AUDF1
        STA AUDC1
        RTS
```



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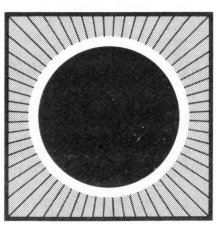

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A look at Modems

by Charles Bachand

One of the most exciting possibilities open to computer users is in the field of telecommunication, the passing of data back and forth over a telephone line. Unfortunately, Ma Bell is not set up to handle the transmission of binary data. It has to be converted to a more suitable medium, in this case that of sound waves. The little black box that handles this magical process is known as a modem.

Sending data over a phone is very similar to sending data to a cassette recorder. Both procedures require the generation of different audio frequencies. With a cassette recorder, only two different frequencies are needed to represent the one's and zero's of binary data. A high bit is represented by a 5326 Hz tone while a low bit uses a frequency of 3995 Hz. The data to and from a cassette recorder gets transfered at a speed of 600 baud (600 bits/sec). This works out to 60 bytes/sec, though in actuality the speed is somewhat less, mainly due to inter-record gaps, the silent passages recorded between records on a tape.

A modem operates a little differently. Instead of using two separate frequencies, a modem requires four. This is because a modem has to have the ability to send and receive data simultaneously. It also needs two separate sets of frequencies: one set for transmitting and one for receiving. This is necessary, since your telephone incorporates an audio feedback circuit. You might have noticed that when you talk into the transmitter end of a telephone, you are still able to hear your own voice, although attenuated, in the receiver. The psychological reinforcement this produces allows one to use a telephone with much more confidence. Otherwise, you might start thinking that the line was dead, or that the other person might not be able to hear you. With this in mind, if we were to use a system with only two tones, our computer might interpret data we were sending out as coming from the other computer. To alleviate this problem, we use two sets of frequencies. One group of tones is sent by the modem originating the call. Here we use audio tone of 1070 Hz to represent a logic 0 and 1270 Hz to represent a logic 1. The modem that is answering the call on the other end of the line sends back data using 2025 Hz for logic 0 and 2225 Hz for a logic 1.

Most modems are designed to connect to a computer through an interface using the RS-232C standard, though some of the new dedicated modems connect through the serial I/O connector or through one of the joystick ports. The use of the RS-232C standard can be traced back to the computer's dark ages, some 20 years ago, when telecommunication was in its infancy. No one then had heard of present day TTL circuitry, which is based on a 5 volt power supply. Back then all they had were computers which used two power supply voltages (+12 and -12 volts). So it's no wonder that the voltage levels they decided upon for their interface standard were based on the voltages +12 and -12. Most standard modems need an 850 Interface Module to work with an Atari computer. The 850 converts the +12 to -12 volt

signal from the modem to one of a zero to +5 volt level that the computer can handle.

Now let's discuss connecting your modem to the telephone. There are two basic ways to do this. The easiest method, from the manufacturer's standpoint, is the use of an acoustical coupler. This is merely a microphone and speaker combination that is placed in close proximity to the telephone's handset and allows the modem to actually talk and listen through it. The second method is to connect the modem directly to the phone line, bypassing the telephone altogether. This is by far the preferred method since no outside noise will be picked up by the telephone receiver and it also makes available the ability to have the computer dial the phone number for you.

One drawback of direct connect modems, as far as the manufacturer is concerned, is the government certification that each model has to go through in order to legally be attached to your phone line. Ma Bell understandably does not want anything catastrophic happening to their equipment and has specified that any third party hardware must be tested by the FCC as to its design worthiness. In other words, the modem should not be designed in a way that it might short circuit, sending 117 volts of house current into the phone line or acting as a radio transmitter turning the phone line into a giant broadcast antenna.

A less involved method of hooking up a modem is by tying it directly into the telephone. As you will notice I did not say telephone line, but telephone. Your telephone already incorporates the circuitry needed to isolate it from the phone line. Instead of including isolation circuitry in the modem, we can let the telephone's electronics do the isolation work for us. The manufacturing costs are reduced and the need for certification is eliminated since we are not connecting directly to the phone line. The modem is patched into the circuit between the handset and the phone base unit using modular connectors. This necessitates having the phone off the hook while the modem is in use since the phone considers the modem as another receiver.

Now to sum up. Cost-wise, the handset direct connect modem is the cheapest way to go. Performance-wise, the true direct connect modems are the most reliable and feature packed of them all. And when the need for portability arises, the acoustic modem cannot be beat. So it really boils down to what you want your modem to do, and what you can afford. Striking a happy medium is the hard part. □

Low-Cost Printer Interface

Additions for Cassette

by Charles Bachand

The **Low Cost Printer Interface** article by Paul Swanson that appeared in **ANALOG** issue #16 has produced highly favorable remarks from our readership and should encourage the submission of more hardware/software articles in the future. Unfortunately, a very small number of our readers found out that the software would not function properly for them. Those having problems have been cassette-only users. Some were good enough to point out that when they tried the interface and software on a friend's computer which included a disk drive, the whole thing worked perfectly! We re-examined the machine language software that drives the interface. The software will not work with a cassette-only system without the following changes:

1) Delete lines 210 and 220 as they are no longer needed.

2) Change lines 230 and 360 to read:

```
230 POKE 12,216:POKE 13,6:POKE 9,1

360 DATA 208,244,169,128,153,27,3,169,
6,153,28,3,96
```

The added POKE statement at the end of line 230 tricks the computer into thinking that software has been booted from a disk. The DOSINI vector will now work properly. The last byte in line 360 represents a RTS instruction to return control back to BASIC instead of jumping to DOS initialization code that is not there. □

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Public Domain Terminal Software

by Tony Messina

Many of you, I'm sure, read other computer publications and know for a fact that these periodicals have had issues dealing with telecommunications. Usually they contain reviews on modems, tips for effective telecommunicating, articles on available devices and reviews of commercial terminal software. Sounds like this issue of **ANALOG Computing!** One item which I know you have not seen (until now) is an overview of Public Domain Terminal Programs available for Atari computers. Here is what you have been waiting for.

About the list.

The list is not all-inclusive, but it does contain all the programs which are commonly found on various Atari Bulletin Boards, user group libraries, or time sharing services such as Compuserve or The Source. Remember, this is an overview, not a review. The programs are ordered alphabetically and not by any order of preference. I shall try to discuss the main features of each program, any hardware requirements needed to operate a particular program and, of course, give credit to the author(s) if known.

The programs.

AMODEM 4.2 - Jim Steinbrecher
850 Interface/Disk drive required

There are many versions of AMODEM floating around amongst the Atari user community. The major versions 1,2,3,4, etc. were written and released by the author. The .1-.9 additions of any major version were modified by various users and released to the user community. Version 4.2 offers selection of Translation mode, Disk menus from multiple drives, Duplex operation selection, baud rate selection, and upload/download capability with or without error checking. Error-free protocol is via the Ward Christiansen format. Files may be captured and sent to your printer, disk drive, cassette, modem port or screen. This program is very reliable and will work on all AMIS BBS systems and time sharing networks. Some download/upload protocols (binary, for example) are not supported. It is rumored that there exists a compiled version of this program (4.83) as well as a Hayes Smartmodem/autodial

version (4.9). The program is written in Atari BASIC with machine language I/O support routines.

COMM40/80 - Alex M. Stevens
850 Interface/Disk drive required

This is a nifty program. It can use 40 columns or an emulated (via software) 80-column format. The version I have supports uploading/downloading and is *Vidtex* compatible. This lets you call up weather maps or other information on Compuserve or another *Vidtex* system and see them displayed in all of their colorful glory. A status line at the bottom of the screen informs the user of the mode and the status of that mode (on/off.) Another feature allows the use of prestored phone numbers, logon ID's and passwords for use with the Hayes (or Hayes-compatible) Smartmodem. The feature is not fully implemented but is promised to be available soon. Semi-automatic storage to a specified device on buffer full conditions is also implemented. This helps prevent overwriting data when your computer memory is full. The program is written in machine language with the phone number creator/editor written in Atari BASIC.

JTERM - Frank Jones
850 Interface/Disk drive required

As with AMODEM, JTERM has many versions which have been modified by various users and released into the public mainstream. JTERM supports upload/download from/to the disk. Optional features allow selection of Parity, Translation, and Duplex modes. Memory can be dumped to printer, disk or cassette. There are versions around which support Smartmodems. Selective capture of incoming data is available via the select button, so that everything sent and received does not end up in memory unless you want it there. Captured buffers may be sent to any of the previously mentioned devices. All options within the program are selected via combinations of the START, OPTION and SELECT buttons. This program is written in a combination of Atari BASIC and machine language.

TSCOPE - Joe Miller
No 850 Interface needed. Disk Drive is required

TSCOPE is the only program in our list which does *not* need an 850 interface to operate, although it will not hurt anything if you do have one. All interface routines are integrated within the program. This program was originally designed for use by Atari*SIG members on Compuserve. TSCOPE is rapidly gaining in popularity. TSCOPE supports the Atari 835 and 1030 modems as well as all other non-Atari modems. It runs on *all* Atari machines, including the XL series. TSCOPE allows upload/download of ASCII and BINARY files on Compuserve SIG*Atari. Files may be saved to disk also. The format used for the up/downloading is semi-automatic and therefore will not work on anything other than the Compuserve system (at least not yet.) Don't despair: rumor has it that some clever folks have made modifications already, and that a few AMIS Bulletin Boards do in fact support the up/download format of TSCOPE. There are too many features of this program to mention. Let's just say that if you want it, TSCOPE has it. TSCOPE does support *Vidtex* formats on Compuserve. The program is written in machine language.

UP/DOWNLOAD TERMINAL - Bob Hartman
850 Interface/Disk

These programs originally appeared in **ANALOG** issues 2 and 3. Since then, rumor has it that they have been modified by a cast of thousands. They (in the original form) are simple terminal programs designed to allow logon to other systems/BBS's so that you can download more extensive terminal programs. They do allow a SAVE to disk and work very well in many applications. They are written in Atari BASIC with machine language I/O support.

Other programs.

There are other public domain terminal programs out there. Since I have not seen or used them, I'll just list the ones I have heard about. Maybe you'll recognize the name if you happen to run across them in the future. Other programs out there are:

AMISTERM
DATATRAN
DISKLINK
MINITERM
VTERM

How do I get 'em?

The programs I discussed are available in XA2 database on Compuserve. Other places you should look are your local Atari user group library, friends or other time sharing systems, such as The Source. If you're struck in the Atari Telelink I/II syndrome (i.e., no way to dump programs to disk or cassette), then find a good friend, take him out to dinner and discuss the possibility of him getting some of these programs for you. It's worth the cost of a dinner — believe me! If all else fails, use Charles Bachand's program from this issue and start calling the numbers on the BBS list (elsewhere in this issue.) You're bound to find some BBS that has at least one of the above mentioned programs.

And in conclusion...

I've tried to mention the major features of each program. Most have many more. If you do find one on a BBS (or wherever), make sure you get the documentation. Nothing is more frustrating than obtaining a great free program and not knowing how to use it. In addition, once you get one, pass it on to a friend! If you know of any other public domain terminal programs which I missed, please write us here with the information so that we can pass it on. Good luck in your search! □

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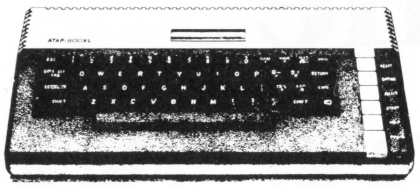

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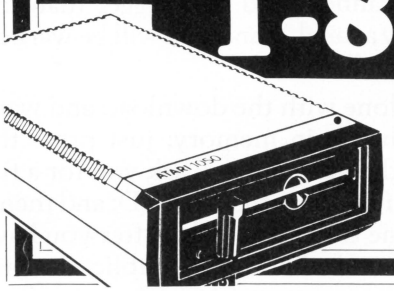

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How to write a modem program in one day

by Charles Bachand

This should not be considered as a full-blown, whiz-bang, do-everything-but-walk-the-dog terminal program. This is more of a bare-bones, kick-it-in-the-side-to-see-if-it's-dead type of program. It was written merely as a simple means of acquiring something better. If you have AMODEM or JTERM or DISKLINK or that great CompuServe downloader TSCOPE then do *not* bother with this program. However, if all you have with your modem and 850 interface module is a **TeleLink** cartridge, then this is what you have been waiting for. (This program will not work with an Atari 835 or 1030 direct connect modem, although we are working on something along those lines).

To run this program, format a new disk and write a copy of DOS II onto it. You will also need to copy the AUTORUN.SYS file from your DOS II master disk to this new disk. This file will allow the 850 to boot with the disk drive on. Next, you run the following BASIC program which will write a binary file named SNS.OBJ to your disk. You now have a disk with four files on it: DOS.SYS, DUP.SYS, AUTORUN.SYS and SNS.OBJ. Now comes the tricky part. You have to append the SNS.OBJ file onto the AUTORUN.SYS file. We do this with the copy command in DOS II by typing:

```
C
SNS.OBJ,AUTORUN.SYS/A
```

You can now try out your new toy by turning on your computer *after* power has been applied to the 850, your modem and your disk drive. Remember, this is a bare-bones system. It cannot dial for you and it will not type logon commands for you. It does not have a screen buffer and it will not fine scroll, but it *does* have a text capture buffer. When you wish to download text to your computer to save on a disk or cassette simply press the START key. The computer will begin putting all the text it receives from the modem into its memory. You then proceed to read a program from the bulletin board you are connected with. Besides the text going to the screen, it is also being put into memory. Remember, this is only a capture buffer. It cannot hold files bigger than the amount of memory available and you will be warned when the buffer is full.

When you are done with the download and want to save the text that is in memory, just press the SELECT key and the program will ask you for a file name. Just type C: for a cassette save or D: and then a valid DOS file name to save to disk. After you have now acquired one of the better public domain

modem programs, you need never use the **Saturday Night Special** again. After all, no one is going to use a do-nothing program like this more than once, are they? □

BASIC Listing.

```
10 REM *** SATURDAY NIGHT SPECIAL ***
20 DATA 0,1,2,3,4,5,6,7,8,9,0,0,0,0,0,
0,0,10,11,12,13,14,15
30 DIM DAT$(99),HEX(22):FOR X=0 TO 22:
READ N:HEX(X)=N:NEXT X:LINE=990:RESTOR
E 1000:TRAP 110:? "CHECKING DATA"
40 LINE=LINE+10:? "LINE:";LINE:READ DA
T$:IF LEN(DAT$)<>98 THEN 160
50 DATLIN=PEEK(183)+PEEK(184)*256:IF D
ATLIN<>LINE THEN ? "LINE ";LINE;" MISS
ING!":END
60 FOR X=1 TO 97 STEP 2:D1=ASC(DAT$(X,
X))-48:D2=ASC(DAT$(X+1,X+1))-48:BYTE=H
EX(D1)*16+HEX(D2)
70 IF PASS=2 THEN PUT #1,BYTE:NEXT X:R
EAD CHKSUM:GOTO 40
80 TOTAL=TOTAL+BYTE:IF TOTAL>999 THEN
TOTAL=TOTAL-1000
90 NEXT X:READ CHKSUM:IF TOTAL=CHKSUM
THEN 40
100 GOTO 160
110 IF PEEK(195)<>6 THEN 160
120 IF PASS=2 THEN PUT #1,224:PUT #1,2
:PUT #1,225:PUT #1,2:PUT #1,0:PUT #1,3
6:CLOSE #1:END
130 ? "INSERT DISK, PRESS RETURN";:DIM
 IN$(1):INPUT IN$:OPEN #1,8,0,"D:SNS.0
BJ"
140 PUT #1,255:PUT #1,255:PUT #1,0:PUT
 #1,36:PUT #1,75:PUT #1,38:GOTO 150
150 ? :? "WRITING FILE":PASS=2:LINE=99
0:RESTORE 1000:TRAP 110:GOTO 40
160 ? "BAD DATA: LINE ";LINE:END
1000 DATA 208024A900855209748DC80220B4
24A231A024206D24A220A990D9D42032056E4AD
EB02F00620F5244C1624204E254C1624,372
1010 DATA 5445524D494E414C204D4F44459B
42554646455220465 4C4C7D9B534156452042
5546464552204F4E9B53415645204445,110
1020 DATA 564943453A4B3A9B523A9B8E4403
8C4503A200A9099D42039D49034C56E4A210A9
0C9D42032056E4A9679D4403A9249D45,522
1030 DATA 03A9039D4203A9049D4A03A9009D
4B034C56E4A900858 0A220A90C9D42034C56E4
20A624A9609D4403A9249D4503A9229D,76
1040 DATA 4203A9C09D4A032056E4A9269D42
03A9009D4A032056E4A9039D4203A90D9D4A03
2056E4A9289D4203A9009D4A034C56E4,656
1050 DATA A220A9079D4203A9009D48039D49
032056E4C908D002A97EC920B00160A68048F0
253023A0009181E681D002E6820582CD,41
1060 DATA E602D012A581CDE502D00BA9FF85
80A23FA024206D24A200A90B9D4203 8A9D4803
9D4903684C56E4ADFC02C9FFF02DA210,742
1070 DATA A9009D48039D4903A9079D420320
56E4C97ED002A908A2204 8A9009D48039D4903
A90B9D4203682056E460AD1FD0C907F0,550
1080 DATA F8C906D01AA680D016E680A96085
81A92685 82A9248DC802A24CA0244C6D24C905
D0D6A580F0D220A624A200A95B9D4403,576
1090 DATA A9249D4503A90C9D4803A9009D49
03A90B9D42032056E4A9059D4203A9149D4803
8A9D4903A94C9D4403A9269D45032056,796
1100 DATA E4ADC26C99BD00568684C072A42
20A9039D4203A94C9D4403A9269D4503A9089D
4A03A9009D4B032056E4309BA000A99B,553
1110 DATA 9181E681D002E682A90B9D4203A9
609D4403A9269D4503 8A581E9609D4803A582
E9269D49032056E430034C07244CAF25,605
```

CHECKSUM DATA

(See page 21)

```
10 DATA 879,957,832,439,727,195,599,55
3,272,701,611,124,258,778,36,7961
160 DATA 165,622,524,790,596,903,437,1
87,925,68,863,946,816,7842
```

Assembly Listing.

```
; ---------------------------
; THE SATURDAY NIGHT SPECIAL
; ---------------------------
;
; The One Day Terminal Program!
;
; by Charles Bachand
;
; START--> opens capture buffer.
; SELECT-> saves buffer after
;          requesting filename.
;          TERM mode reentered
;          if [RETURN] only!
;
; System Equates
; --------------
;
LMARGN  =   $52     ;left margin
COLOR4  =   $02C8   ;border color
MEMTOP  =   $02E5   ;memory top pntr
BCOUNT  =   $02EB   ;RS-232 buff cnt
CH      =   $02FC   ;keyboard buffer
ICCOM   =   $0342   ;CIO command
ICBADR  =   $0344   ;CIO buff addr
ICBLEN  =   $0348   ;CIO buff len
ICAUX1  =   $034A   ;CIO aux byte 1
ICAUX2  =   $034B   ;CIO aux byte 2
CONSOL  =   $D01F   ;console keys
CIOV    =   $E456   ;CIO vector
;
; Zero Page Variables
; -------------------
;
        *=  $80     ;page zero data
;
SAV     *=  *+1     ;download flag
ADDR    *=  *+2     ;memory pointer
;
; Program starts here
; -------------------
;
        *=  $2400   ;program here
;
SNS     JSR KOPEN   ;open keyboard
        LDA #0      ;get zero
        STA LMARGN  ;40 column screen
REOPEN  LDA #$74    ;blue
        STA COLOR4  ;for background
        JSR INITR   ;init RS-232
        LDX # <TMTX ;text addr lo
        LDY # >TMTX ;text addr hi
        JSR PRINT   ;? "TERM MODE"
RSTAT   LDX #$20    ;IOCB #2
        LDA #13     ;status command
        STA ICCOM,X ;CIO command byte
        JSR CIOV    ;STATUS #2
        LDA BCOUNT  ;buffer count
        BEQ KCHECK  ;empty? Yes.
        JSR GET232  ;No. get byte
        JMP RSTAT   ;continue
KCHECK  JSR READK   ;check keys
        JMP RSTAT   ;continue
;
; Text Boes Here
; --------------
;
TMTX    .BYTE "TERMINAL MODE",$9B
BFTX    .BYTE "BUFFER FULL",$7D,$9B
SQTX    .BYTE "SAVE BUFFER ON",$9B
SDTX    .BYTE "SAVE DEVICE:"
KNAME   .BYTE "K:",$9B
RNAME   .BYTE "R:",$9B
;
; Text Printing Routine
; ---------------------
;
PRINT   STX ICBADR  ;text addr lo
        STY ICBADR+1 ;text addr hi
        LDX #0      ;IOCB #0
        LDA #9      ;write record
        STA ICCOM,X ;CIO command
        STA ICBLEN+1,X ;large length
        JMP CIOV    ;print string
;
; Open keyboard for input
; -----------------------
;
KOPEN   LDX #$10    ;use IOCB #1
        LDA #12     ;close command
        STA ICCOM,X ;CIO command byte
        JSR CIOV    ;CLOSE #1
        LDA # <KNAME ;fname addr lo
        STA ICBADR,X ;CIO buf addr lo
        LDA # >KNAME ;fname addr hi
        STA ICBADR+1,X ;CIO buf addr hi
        LDA #3      ;open command
        STA ICCOM,X ;CIO command byte
        LDA #4      ;for input
        STA ICAUX1,X ;CIO aux byte #1
        LDA #0
        STA ICAUX2,X ;CIO aux byte #2
        JMP CIOV    ;OPEN #1,4,0,"K:"
;
; Close File #2
; -------------
;
CLOSE2  LDA #0      ;get zero
        STA SAV     ;clear SAVE flag
        LDX #$20    ;use IOCB #2
        LDA #12     ;close command
        STA ICCOM,X ;CIO command byte
        JMP CIOV    ;CLOSE #2
```

```
;
; Initialize R: Device
; --------------------
;
; turn DTR line on
;
INITR   JSR CLOSE2  ;CLOSE #2
        LDA # <RNAME ;fname addr lo
        STA ICBADR,X ;CIO addr lo
        LDA # >RNAME ;fname addr hi
        STA ICBADR+1,X ;CIO addr hi
        LDA #34     ;special command
        STA ICCOM,X ;CIO command
        LDA #192    ;DTR on
        STA ICAUX1,X ;CIO aux byte 1
        JSR CIOV    ;XIO 34,#2,192,0,"R:"
;
; Set for light translation
;
        LDA #38     ;special command
        STA ICCOM,X ;CIO command
        LDA #0      ;light trans
        STA ICAUX1,X ;CIO aux byte 1
        JSR CIOV    ;XIO 38,#2,0,0,"R:"
;
; Open "R:" for read/write mode
;
        LDA #3      ;open command
        STA ICCOM,X ;CIO command
        LDA #13     ;read/write opt
        STA ICAUX1,X ;CIO aux byte 1
        JSR CIOV    ;OPEN #2,13,0,"R:"
;
; Enable concurrent mode I/O
;
        LDA #40     ;concurrent cmd
        STA ICCOM,X ;CIO command
        LDA #0      ;
        STA ICAUX1,X ;CIO aux byte 1
        JMP CIOV    ;XIO 40,#2,0,0,"R:"
;
; Read RS-232 device
; ------------------
;
GET232  LDX #$20    ;IOCB #2
        LDA #7      ;get char cmd
        STA ICCOM,X ;CIO command
        LDA #0      ;get zero
        STA ICBLEN,X ;CIO length lo
        STA ICBLEN+1,X ;CIO length hi
        JSR CIOV    ;GET #2,CHAR
        CMP #8      ;ASCII BS?
        BNE NOBS    ;No. skip
        LDA #126    ;make ATASCII BS
NOBS    CMP #32     ;Yes. char<32?
        BCS CFLAG   ;Yes. ignore it
        RTS         ;return
CFLAG   LDX SAV     ;get sav flag
        PHA         ;save Acc
        BEQ NOPOKE  ;download? No.
        BMI NOPOKE  ;buffer full?
        LDY #0      ;No. zero offset
        STA (ADDR),Y ;save byte
        INC ADDR    ;pointer lo
        BNE NCARRY  ;overflow? No.
        INC ADDR+1  ;pointer hi
NCARRY  LDA ADDR+1  ;compare pntr hi
        CMP MEMTOP+1 ;with MEMTOP hi
        BNE NOPOKE  ;same? No.
        LDA ADDR    ;compare pntr lo
        CMP MEMTOP  ;with MEMTOP lo
        BNE NOPOKE  ;same? No.
        LDA #$FF    ;buff full flag
        STA SAV     ;set flag
        LDX # <BFTX ;text lo
        LDY # >BFTX ;text hi
        JSR PRINT   ;? "BUFFER FULL"
NOPOKE  LDX #0      ;IOCB #0
        LDA #11     ;put char cmd
        STA ICCOM,X ;CIO command
        TXA         ;get zero
        STA ICBLEN,X ;CIO length lo
        STA ICBLEN+1,X ;CIO length hi
        PLA         ;restore Acc
        JMP CIOV    ;print char
;
; Read keyboard and console
; -------------------------
;
READK   LDA CH      ;keyboard buffer
        CMP #$FF    ;key pressed?
        BEQ CHKCON  ;No. skip next
        LDX #$10    ;IOCB #1
        LDA #0      ;get zero
        STA ICBLEN,X ;CIO buff len lo
        STA ICBLEN+1,X ;CIO buf len hi
        LDA #7      ;get char
        STA ICCOM,X ;CIO command
        JSR CIOV    ;read keyboard
        CMP #126    ;ATASCII BS?
        BNE NOABS   ;No. skip
        LDA #8      ;make ASCII BS
NOABS   LDX #$20    ;IOCB #2
        PHA         ;save Acc
        LDA #0      ;get zero
        STA ICBLEN,X ;CIO buf len lo
        STA ICBLEN+1,X ;CIO buf len hi
        LDA #11     ;put char
        STA ICCOM,X ;CIO command
        PLA         ;restore Acc
        JSR CIOV    ;write RS-232
CXIT    RTS         ;return
CHKCON  LDA CONSOL  ;console keys
        CMP #7      ;any pressed?
        BEQ CXIT    ;No. return
        CMP #6      ;START key?
        BNE TRY5    ;No. skip next
        LDX SAV     ;save buffer on?
        BNE TRY5    ;Yes. skip next
        INC SAV     ;No. turn it on
        LDA # <BUFF ;buffer addr lo
        STA ADDR    ;buffer pntr lo
        LDA # >BUFF ;buffer addr hi
        STA ADDR+1  ;buffer pntr hi
        LDA #$24    ;dark orange
        STA COLOR4  ;border color
        LDX # <SDTX ;text addr lo
        LDY # >SDTX ;text addr hi
        JMP PRINT   ;? "SAVE BUFFER ON"
TRY5    CMP #5      ;OPTION pressed?
        BNE CXIT    ;No. return
        LDA SAV     ;buffer on?
        BEQ CXIT    ;No. return
FNTRAP  JSR CLOSE2  ;CLOSE #2
        LDX #0      ;IOCB #0
        LDA # <SDTX ;text addr lo
        STA ICBADR,X ;CIO addr lo
        LDA # >SDTX ;text addr hi
        STA ICBADR+1,X ;CIO addr hi
        LDA #12     ;message length
        STA ICBLEN,X ;CIO length lo
        LDA #0      ;get zero
        STA ICBLEN+1,X ;CIO length hi
        LDA #11     ;put characters
        STA ICCOM,X ;CIO command
        JSR CIOV    ;? "SAVE DEVICE?";
        LDA #5      ;get record
        STA ICCOM,X ;CIO command
        LDA #20     ;20 char max
        STA ICBLEN,X ;CIO length lo
        TXA         ;get zero
        STA ICBLEN+1,X ;CIO length hi
        LDA # <FNAME ;filename area lo
        STA ICBADR,X ;CIO addr lo
        LDA # >FNAME ;filename area hi
        STA ICBADR+1,X ;CIO addr hi
        JSR CIOV    ;get filename
        LDA FNAME
        CMP #$9B    ;carriage return?
        BNE FILSAV  ;No. try to save
        PLA         ;pop return lo
        PLA         ;pop return hi
        JMP REOPEN  ;continue
FILSAV  LDX #$20    ;IOCB #2
        LDA #3      ;OPEN file cmd
        STA ICCOM,X ;CIO command
        LDA # <FNAME ;name addr lo
        STA ICBADR,X ;CIO addr lo
        LDA # >FNAME ;name addr hi
        STA ICBADR+1,X ;CIO addr hi
        LDA #8      ;for output
        STA ICAUX1,X ;CIO aux byte 1
        LDA #0      ;get zero
        STA ICAUX2,X ;CIO aux byte 2
        JSR CIOV    ;open file
        BMI FNTRAP  ;error? Yes.
        LDY #0      ;zero offset
        LDA #$9B    ;carriage return
        STA (ADDR),Y ;at end of file
        INC ADDR    ;pointer lo
        BNE SKIPHI  ;overflow? No.
        INC ADDR+1  ;Yes. pointer hi
SKIPHI  LDA #11     ;put characters
        STA ICCOM,X ;CIO command
        LDA # <BUFF ;file buffer lo
        STA ICBADR,X ;CIO buf addr lo
        LDA # >BUFF ;file buffer hi
        STA ICBADR+1,X ;CIO buf addr hi
        SEC         ;set carry
        LDA ADDR    ;end of file lo
        SBC # <BUFF ;beginning lo
        STA ICBLEN,X ;CIO length lo
        LDA ADDR+1  ;end of file hi
        SBC # >BUFF ;beginning hi
        STA ICBLEN+1,X ;CIO length hi
        JSR CIOV    ;write file
        BMI TRAP2   ;bad write? Yes.
        JMP REOPEN  ;done
TRAP2   JMP FNTRAP  ;retry
;
FNAME   *=  *+20    ;filename buffer
BUFF    *=  *+1     ;capture buffer
;
; SET UP PROGRAM RUN ADDRESS
;
        *=  $02E0   ;DOS run address
        .WORD SNS   ;run addr data
;
        .END
```

Attention Programmers!

ANALOG Computing is interested in programs, articles, and software review submissions dealing with the Atari home computers. If you feel that you can write as well as you can program, then submit those articles and reviews that have been floating around in your head, awaiting publication. This is your opportunity to share your knowledge with the growing family of Atari computer owners. **ANALOG** pays between $30.00-$360.00 for all articles. All submissions for publication must be typed, upper and lower case with double spacing. Program listings should be provided in printed form, and on cassette or disk. By submitting articles to **ANALOG Computing**, authors acknowledge that such materials, upon acceptance for publication, become the exclusive property of **ANALOG**. If not accepted for publication, the articles and/or programs will remain the property of the author. If submissions are to be returned, please supply a self-addressed, stamped envelope. All submissions of any kind must be accompanied by the author's full address and telephone number. Send programs to: Editor, **ANALOG Computing**, P.O. Box 23, Worcester, MA 01603.

Touch-Tone® Dialer for your Atari

by Tom Hudson

When the Atari computers' sound capabilities are being discussed, most people automatically think of the explosion and "zap" sounds common in game programs. Actually, these sound effects barely scratch the surface of the sound generation capabilities of Atari computers.

One example of the amazing things possible which Atari sound is **SAM**, the **Software Automatic Mouth**, from Don't Ask Software. **SAM** is a program which makes it possible for your computer to talk without any additional hardware. Although **SAM** has a couple of drawbacks, it is one practical use of the heretofore game-bound sound channels.

Phone fun.

Another interesting use of the Atari sound generation system is the generation of Touch-Tone® frequencies.

Touch-Tone® is the trademark for the "beep" sounds used in most push-button telephones. Every time you push one of the keys on a Touch-Tone® telephone, the phone generates two separate pitches, or frequencies. **Figure 1** shows the standard Touch-Tone® keyboard, along with the seven frequencies used.

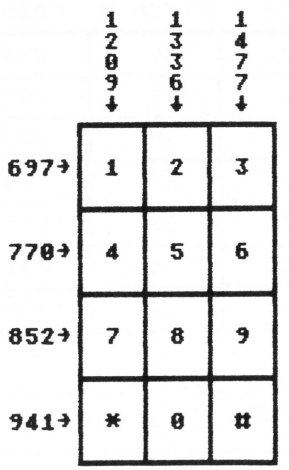

Figure 1.

If you look at **Figure 1**, you will see that there is a frequency for each column of numbers, and one for each row. All frequencies are in hertz, or cycles per second. When you press a key, the frequencies for that column and row are sent out over the phone line to the phone company's switching equipment, which

converts the tones back into the proper digit. If you press the number 6, for example, the frequencies 770 and 1477 hertz are selected. If you press 7, the phone sends the frequencies 852 and 1209 hertz.

What most people don't know is that these tones don't have to come from the telephone itself. If you're an extremely talented whistler, you could dial a number simply by whistling seven tones!

Fortunately for us non-whistlers, the Atari computer can be commanded to produce the frequencies needed by the phone system. By sending out the proper combinations, we can dial the phone simply by holding the handset up to the television speaker. This will work with any phone on a Touch-Tone® system, even rotary-dial phones. Just be sure your local exchange can handle Touch-Tone® codes.

Preliminary work.

In order for the computer to simulate the Touch-Tone® frequency system, it must send out two separate frequencies. This is no problem, since the Atari computers feature *four* independent sound channels. For our purposes, we'll use channels 1 and 2.

Next, we have to determine how to get the frequencies we want. The number necessary in the Atari BASIC SOUND command to produce a specific frequency can be found by the following formula:

```
PITCH # = ( 63910 / FREQ ) / 2
```

Using this formula for all seven of the Touch-Tone® frequencies, we come up with the following table:

TOUCH-TONE FREQUENCY	PITCH #	ATARI FREQUENCY
697 HZ.	46	695 HZ.
770 HZ.	42	761 HZ.
852 HZ.	38	841 HZ.
941 HZ.	34	940 HZ.
1209 HZ.	26	1229 HZ.
1336 HZ.	24	1332 HZ.
1477 HZ.	22	1453 HZ.

With tone frequencies in hand, we're now ready to write our Touch-Tone® program.

Line 80 DIMensions three important variables. F1 and F2 are the arrays for the two frequency values, loaded from the DATA in Lines 350-460. PN$ holds the desired phone number, up to 20 digits long. If necessary, you can make this string any length.

Line 100 reads the frequency DATA and places it into the F1 and F2 arrays. The two frequencies for the number 6, for example, are found in F1(6) and F2(6). Positions 10 and 11 are special cases, and hold the frequencies for the "*" and "#" keys, respectively.

Lines 120-130 accept the phone number from the keyboard, placing it in the PN$ string. Be careful when entering values here: the program will only produce tones for the 12 Touch-Tone® characters.

Line 150 starts the actual dialing process, with a FOR-NEXT loop. The loop will process each character of PN$.

Line 170 checks the current character to see if it is the "*" character. If it is, the program sets the variable N to 10 and execution continues at Line 220.

Line 190 checks to see if the character is the "#" character. If so, the variable N is set to 11, and the program continues at Line 220.

Line 210 sets the variable N to the value of the digit of PN$ indicated by the variable X. This number will be from 0-9.

Line 230 sends out the two frequencies for the number indicated by the variable N. The sounds sent are pure tones (10) and are sent at volume 4. If you would like to adjust the volume, just remember to change BOTH of the SOUND statements.

Line 250 is a FOR-NEXT loop which leaves the two frequencies on for 40 counts. This insures that the tone will be recognized by the phone company switching equipment.

Line 270 turns the tones off.

Line 290 is another FOR-NEXT loop which leaves the sounds off for 20 counts.

Line 310 completes the first FOR-NEXT loop started in Line 150, so the program will loop back and get the next digit of the number to be dialed. If all digits have already been sent, the program falls through to Line 330.

Line 330 goes back to Line 120 to accept the next phone number.

Line 350-460 are the frequency values for the dialer. Line 350 contains the two frequencies for the number 0; 360 contains those for the number 1, etc. Lines 450 and 460 are special cases, and hold the values for the "*" and "#" keys, respectively.

What do you do with it?

Some of our more practical readers are probably asking, "What in the world is this program good for?"

First, you could store frequently-used phone numbers on disk and write a program to recall them when needed. This could be particularly good for a severely handicapped individual. The good part is that the program works even with rotary equipment, as long as your local phone company supports Touch-Tone®.

Second, some of the "cheap" long-distance services, such as MCI, require you to enter a personal access code. If you don't have Touch-Tone® equipment, you can't do this. Radio Shack sells a small Touch-Tone® "beeper" unit ($24.95) for this purpose. Is typing this program worth it? You be the judge.

Lastly, this program makes a nice demonstration of some of the odd things your computer can be used for, especially if somebody says the Atari is "just a game machine." If you belong to an Atari user group, get up on stage and let them know what this little machine can do. Some of them may have more applications for this program, and we'd like to hear about them. □

```
10 REM ****************************
20 REM * TOUCH-TONE (TM) DIALER *
30 REM *                        *
40 REM *     BY: TOM HUDSON     *
50 REM *  ANALOG COMPUTING #19  *
60 REM ****************************
70 REM *** SET UP ARRAYS ***
80 DIM F1(11),F2(11),PN$(20)
90 REM *** LOAD FREQUENCY DATA ***
100 FOR X=0 TO 11:READ A,B:F1(X)=A:F2(
X)=B:NEXT X
110 REM *** GET PHONE # TO DIAL ***
120 PRINT "ENTER NUMBER TO DIAL"
130 INPUT PN$:TRAP 120
140 REM *** NOW DIAL IT! ***
150 FOR X=1 TO LEN(PN$)
160 REM *** IS IT *? ***
170 IF PN$(X,X)="*" THEN N=10:GOTO 220
180 REM *** IS IT #? ***
190 IF PN$(X,X)="#" THEN N=11:GOTO 220
200 REM *** GET DIGIT OF NUMBER ***
210 N=VAL(PN$(X,X))
220 REM *** NOW START BOTH TONES! ***
230 SOUND 1,F1(N),10,4:SOUND 2,F2(N),1
0,4
240 REM *** LEAVE TONE ON A MOMENT ***
250 FOR D=1 TO 40:NEXT D
260 REM *** NOW TURN TONES OFF ***
270 SOUND 1,0,0,0:SOUND 2,0,0,0
280 REM *** LEAVE OFF A MOMENT ***
290 FOR D=1 TO 20:NEXT D
300 REM *** NOW DO NEXT DIGIT! ***
310 NEXT X
320 REM *** ALL DONE, GET NEW # ***
330 GOTO 120
340 REM *** TONE DATA ***
350 DATA 23,34
360 DATA 26,46
370 DATA 24,46
380 DATA 22,46
390 DATA 26,42
400 DATA 24,42
410 DATA 22,42
420 DATA 26,38
430 DATA 24,38
440 DATA 22,38
450 DATA 26,34
460 DATA 22,34
```

●

CHECKSUM DATA

(See page 21)

```
10 DATA 280,408,804,862,182,290,812,39
2,478,326,189,345,132,638,929,7067
160 DATA 945,487,937,489,266,715,989,8
75,649,125,655,995,498,133,499,9257
310 DATA 765,93,702,232,747,767,764,76
1,764,733,730,761,758,755,758,10090
460 DATA 749,749
```

A Terminal Program for your Atari

Teletari
DON'T ASK Computer Software
2265 Westwood BLVD B-150
LOS Angeles, Ca. 90064
$29.95

by Tony Messina

Do you have a problem with your current terminal software? Problems such as not being able to save your communications to disk or not being able to do anything but talk to a modem. In short, is your terminal software really terminal? If you are frustrated with the limitations of your current package then **Tele-tari** may be what you need.

An overview.

Tele-Tari is a communications package which requires a disk drive, 32k of memory and an 850 interface module. It has a host of features not found in many other packages. The most important is the ability to configure ports other than port 1 on the 850 interface module.

The flexibility of **Tele-tari** is just a little short of amazing. I have used this package to talk to plotters, printers, mainframes, Motorola 68000 development boards, video-disc players and even a microwave oven (no comment!). The program is easy to use and guides the user with various menus. On power-up the main menu consists of the following selections:

Online — puts computer in online mode
Save — saves buffer to disk
Load — Loads buffer from disk
Review — Allows review of text in current buffer
Print — Sends buffer contents to a printer
Upload — sends contents of buffer to other computer
Directory — allows viewing of the disk directory files
Terminal Parameters — allows selection of various parameters

Most of the above are pretty self-explanatory. The Terminal parameters option allows you to configure any port on the 850 interface module. Selection of this option produces yet another menu from which to make your selections. Items which can be altered under this menu are:

port number
baud rate
stop bits
bits per word
input/output parity
translation mode
monitor of DSR,CTS,CRX input lines
monitor of DTR,RTS,XMT output lines
Selection of XON/XOFF enable
Ignore/process incoming control characters
Line feed after carriage return
Selection of Ascii or ATASCII delete when DELETE-BACKSPACE key is hit
Screen margin adjustments

That's quite a bit of stuff. All selections are made via a few simple keystrokes. This makes the program very easy to use.

Documentation.

A 32-page owner's guide accompanies the package. The guide is written in plain English, not "jargonese." All functions are covered, as well as hints/tips on transfering programs. Chapter 15 also includes a handy list of Public Access Message Systems along with their phone numbers. This type of list changes like the weather but I did find many numbers to be valid.

Although this program is very flexible (I do use it quite often) there are some things which bug me and should possibly be changed. Directory access is allowed only on disk 1. Those of us with multiple drives must have our work disk on drive 1. Sending buffers to the printer cannot be stopped unless SYSTEM RESET is hit. This will not harm anything but it isn't really a neat way to abort.

The verdict.

Although I had a few gripes, the program's ease of use, user goof-proofing and flexibility far outweigh them. Anyone who needs to communicate with other devices will find this program far easier to use than any other I have seen. **Tele-Tari** has been around for a while and some enhancements are in the works. I can truthfully say that **Tele-Tari** has been worth every penny of the purchase price and has paid for itself many times over. □

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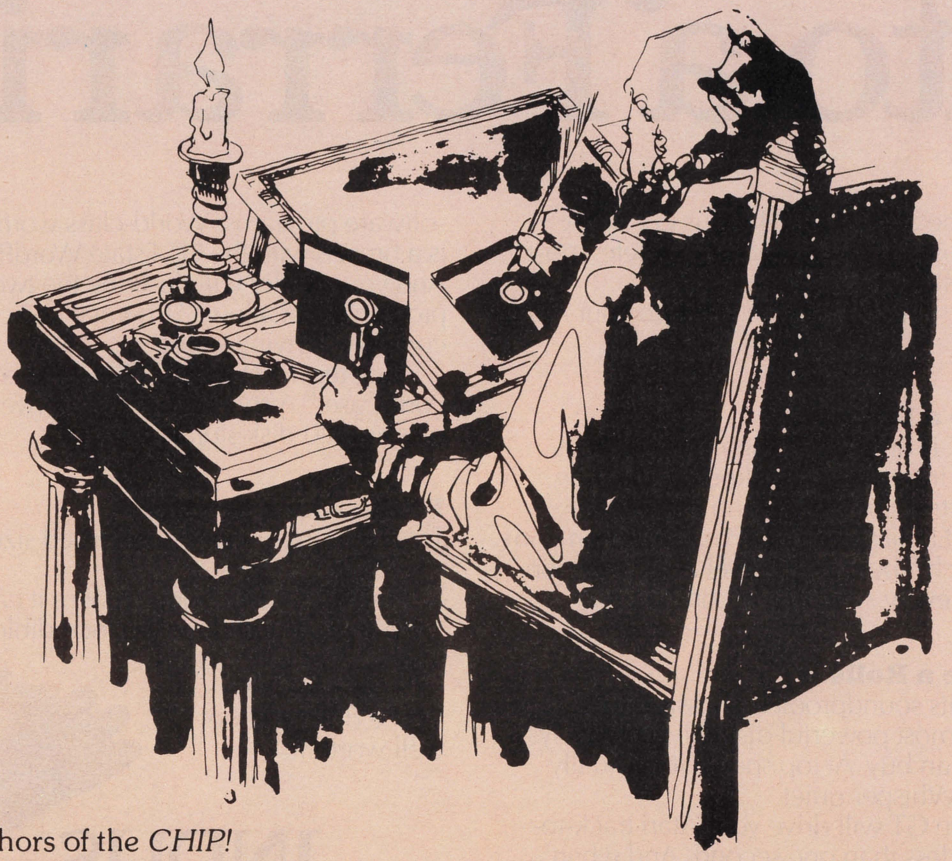

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Educational Computer Games?

by Richard E. Herring

To many people, the title of this article (especially without the question mark) may seem to be a misnomer. There are computer programs which are clearly educational in nature, and games are in abundance for all popular personal computers. It is the proximity of the words "educational" and "games" which causes raised eyebrows. There exist, however, computer games which hold great promise of having real educational value.

Traditionally, education has not been considered a "fun" activity. Many educational computer programs carry this to an extreme by simply replicating dry drill and practice exercises commonly available in workbook form. The only positive aspect these programs add is the use of the computer itself. With a computer, math problems can at least be displayed with large colorful numbers, and immediate feedback can result from each problem attempted.

Arguing that familiarity with computers is extremely important for today's students, some people feel that computerized drill and practice is fine. After all, the child learns to use the keyboard, becomes comfortable with the technology, and benefits from having an unemotional tutor who is ready to work whenever the child wants.

Further, learning, by the nature of the way we impose it, is simply not fun. That is not to say that it is not reinforcing. Indeed, many children move quite well from extrinsic reinforcers to their own schedules of internal reinforcement, intermittently strengthened by praise or grades. Yet the fact that something is reinforcing does not make it fun. Few children will sit down with a spelling workbook, just as few adults will scan a technical journal for fun, even though there is real benefit to be had.

"Fun" is not a very objective or measurable criterion by which to evaluate educational computer games. It would be preferable to have statistically valid data on children's choices of activity when given a variety of ranges of choice. Which games would rate on a level with the children's personal pastimes or hobbies? During which activities would the frequency of smiles and laughter be highest? For which would failure most often result in increased concentration and determination, rather than in giving up? By these criteria, most educational games could not really be considered fun.

Can't games themselves have a real educational

value? Leaving aside the reflexes "learned" by playing **Pacman**, many games do indeed help to develop basic reading, writing and arithmetic skills. The games which do this in the most structured way, and are usually the most accepted in educational circles, often rely on the interpersonal dynamics of game play. In other words, the game itself is not really much fun to the student participants, but the interactions of the students during play is reinforcing.

In a structured setting, where the choice is between playing such games and doing workbook exercises, the games are an easy choice. Once again, a situation exists where children are not liable to pick out these games for true leisure time activity.

Are there games which have undeniable educational value, where the learning to take place is specific and measurable and capable of incorporation into a curriculum? Certainly, there are games which incorporate some of the best educational designs. With few chances for failure, the player/learner is lead progressively from his or her current knowledge base to an expanded one. There are even some of these educational games which students will choose to play, not as the least of several evils, but for fun. Very few computer programs fall into this category.

There are a few good examples where learning in a structured way can also be fun. *Dynacomp*'s **Hodge Podge** is a program which has proven to be entertaining for many young children. For older students, programs like **Rocky Boots** from *The Learning Company* introduce difficult concepts in an enjoyable fashion. My choice for the best type of educational computer game however, is the generic adventure game.

Admittedly, I haven't heard of many adventure games (other than some of *Spinnaker*'s offerings, such as **Snooper Troops**) which claim to be educational. Yet I have no trouble picking adventures as *the* educational computer games. My rationale is simple — adults play adventure games.

That one aspect of adventure games is determinative. Let's look at education from the child's viewpoint. What we see is a system that makes us "work" a lot. Our parents have no homework, no pages of problems to complete, no tests for which to study — at least not that we see at home in the evening. It seems that what grown-ups do, even for claimed "educational" purposes, is their choice and, usually, fun.

In addition, many children simply want to do what their parents do. If you like to wear knit shirts with little alligators on them, you probably know that your children will plead for clothing of a similar status. And, if you have both a personal computer and a child at home, I will bet that at least once that child has wished for his or her own computer.

Adults play adventure games for fun. This can give adventure games some real value in the child's world. Particularly the older child — who can play the same game as the adult, and not a simplified children's version — can perceive status in the play of the game apart from the built-in challenge.

Now let's consider the educational potential I claim for adventure games. Since the arguments hold true for the new graphics adventures, they will not be considered separately from the traditional "text only" adventures. The purpose of an adventure game is to win by completing some difficult task, e.g., slaying dragons, finding treasures, navigating oceans and solving puzzles.

What is really happening as you explore this interactive mini-novel called an adventure? First, you do a fair amount of reading. Your current location, visible objects and the directions available for travel must all be described on the screen. After each command you give, the descriptions change. You cannot just skim descriptions, either. Try to discern the difference between a "teeny tiny little maze" and a "tiny teeny little maze" if you are not reading closely.

Then you must *say* what to do next. Most commonly, you will type in a two-word command in verb/noun format. You had better know at least two parts of speech. No incorrect spelling is permitted. If your format or spelling is wrong, you will have to try the command again. In the meantime, your lantern may be running out of fuel.

While you are doing all this, you must be thinking analytically. What object have you passed which will prevent you from being burned by the dragon's breath? Oh yes, but where was it, and how do you get back there? Have you ever drawn a map? Adult or child, if you play adventure games, you probably have.

Not every adventure game is an educational masterpiece. Games with misspelled words or swamps in hotel lobbies lose their value for both education and fun. Adventure games do provide an excellent medium for education. There is no reason why games could not be written with specific vocabulary lists or with arithmetic computation required to solve certain puzzles. Since mapping your progress is usually necessary, an adventure game could probably even introduce the basic concepts of non-linear space-time.

In order for a child to choose to play a game, whether educational or not, it must be perceived as fun. We have effectively taught many children to believe that the types of educational games which they see used in school, but never played at home by adults, are games which are not inherently fun. Obviously fun, judging by their wide following of computer game players, adventure games offer an alternative. With adequate design, adventure games are flexible enough to incorporate nearly any subject into a format which will seem, to the learner, to be only secondarily educational. □

CHANCELLOR OF THE EXCHEQUER
MACH-INA STRATEGY GAMES
161 Aragon Avenue
Coral Gables, FL 33134
48K Disk $29.95

by Bob Curtin

This review was supposed to be turned in a month ago, but I was so impressed with this program I wanted to do more than review the game on first impression.

Looking at the credits in the documentation I noted that the game was designed by R.C. Chiofolo, Ph.D. Mr. Chiofolo is a long time boardgamer and computer programmer who had, in the past, converted some (now defunct) SIMULATIONS PUBLICATIONS, INC. materials to computer. That experience sparked the inspiration for a design of his own, and **COE** is the result. The game is based on an historical situation in England in the early nineteenth century, at the beginning of the industrial revolution. Great Britain is divided into eight regions with varying resources, populations, money reserves, manufacturing capacity, and transportation nets. The objective of the game is "...to achieve top hole rating on the Analysis Program Graph. To do this you must merge all eight Regions with Great Britain, maximize population and machine utilization, and have at least 55,000 pounds sterling in the Exchequer by 1915." This is achieved through production of natural resources and crops, manufacturing of tools, factories, transportation, arms and consumer goods, and the allocation of these different resources in the eight regions for maximum effectiveness.

Interregional trade is of utmost importance, since most of the regions don't have balanced output of resources. The idea is to trade what you do have for that which you don't, manufacture the tools and machinery to make production more efficient, get rid of the excess population (by inducting them into the service or shipping them off to Australia) and building a transportation network to accomplish this.

Sounds simple enough. But there are a few flies in the ointment. For instance, labor strikes, bad weather destroying crops and creating famine, civil unrest, and inflation all work to put you on the losing end of the stick.

Playing the game is easy. All input is through the keyboard, and illegal entries are not allowed. The game takes quite a bit of time to play, expecially when you're new to the system. You can save up to three games, or restart the historical game. Oh yes, those of you who own Epson printers can dump either individual region displays, or all regional displays, to a printer to obtain hard copies for analysis during the play of the game. It takes some hard mental gymnastics to eke out that last bit of efficiency and attain top hole ratings, and the hard copies are definitely needed.

You should also note that trading can take place anytime — before or after, but not during a particular stage. For those times when a little fine tuning is needed in a couple of regions for the next stage, this is invaluable.

The ANALYSIS program is one of the nicest features of the game, and of course the only way you can tell if you've "won" or not. Each of the regions can be analyzed for efficiency, as well as the national rating. This analysis is based on the degree of mechanization, population utilization, income, mergers, and the skill level you chose at the beginning of the game.

This game is definitely not for everyone. The physical playing of **COE** is very easy. The options are always displayed somewhere on the screen and are usually one-touch commands. The complexity of the game lies in the game itself. The manipulation of so many constantly changing variables, and the analyzing of the data is (at least for me) a mind bending experience. If you'd like a teenie insight into what it'd be like to head up an economic organization, buy **COE**. If you thrive on complex problems, buy **COE**. If you enjoy puzzles, buy **COE**. If you like chess, you'll probably like this game. If you're a **Pac-Man** freak, you'll probably hate it.

The Atari is capable of so much more than creating hoardes of galactic killers. Arcade games are a nice diversion and, admittedly, they make an enormous amount of money, but they are just so much intellectual pap. **Chancellor of the Exchequer** is a game which is not only intellectually stimulating, but a program which'll teach you something in the process. I'd like to see more programs on the market like this, perhaps simulating different business environments (management, corporate finance, stock market, *ad infinitum*) or other areas of human endeavor. I hope **COE** does well. □

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CIRCLE #133 ON READER SERVICE CARD.

BRUCE LEE
by Ron J. Fortier
DATASOFT
19808 Nordhoff Place
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32K Disk or Cassette/$34.95

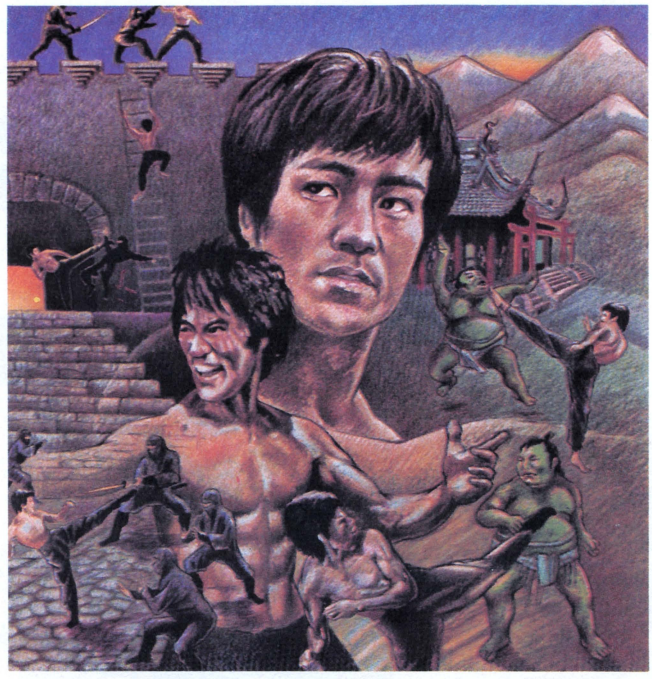
by Michael Des Chenes

Even if you're not into Kung Fu/Karate movies, don't let that stop you from taking a look at Datasoft's newest release, **Bruce Lee**. I must admit that I enjoy watching Sunday afternoon martial arts movies. I don't want to offend any faithful followers of these films, but many offer—if nothing else—good comic relief in the midst of their good guy vs. bad guy vengeance plots. Even if you're not into martial arts, but enjoy computer games with good playability and nice graphics, you should strongly consider **Bruce Lee**.

You have the option of playing against the computer as Bruce Lee, or as an opponent, the Green Yamo. In either choice you can play against the computer, against another player, or take turns with another player. Once the game is booted, you'll have to sit through a short musical intro and a title screen along with a good graphic representation of Bruce Lee. As the title character, your perilous mission is to search for a wizard who dwells within a mighty fortress. After you destroy this evil menace, you can claim his wealth.

Bruce Lee.

You begin the game at the entrance of the fortress. This is one of twenty rooms, each of which you have to explore. Each room is also sealed off from the others. The only way to get to an adjoining room is to jump up and take lanterns that are hanging in various parts of the rooms. Many of the lanterns control the opening of doors and passageways leading to other

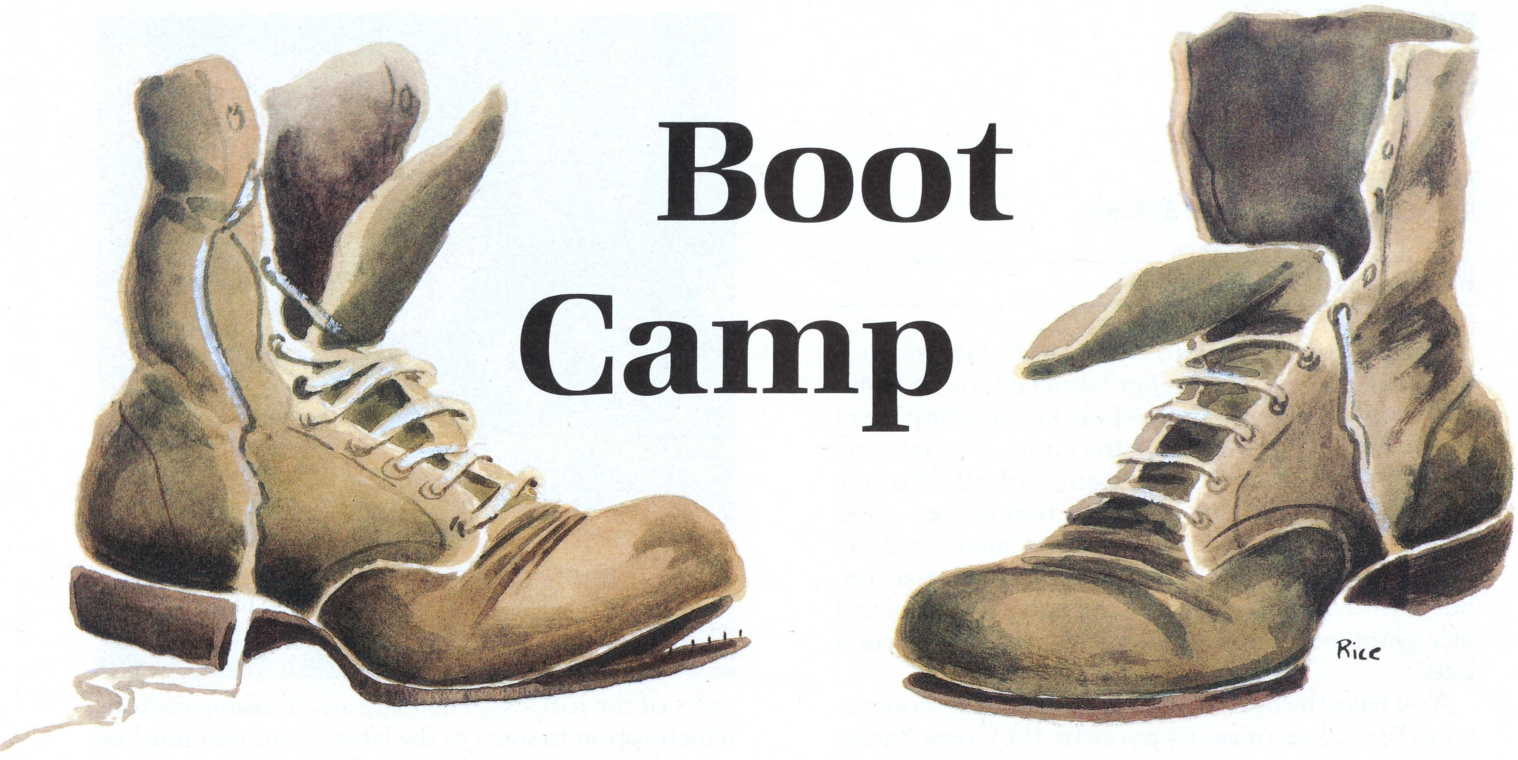


parts of the fortress. There are also flashing buttons which appear in some of the later rooms that must be turned off by touching them. When you've played the game for a while, you will discover which lanterns are important enough to take. The amount of lanterns gathered also determines your final score. At first, I wasn't concerned with what kind of score I had. I just wanted to get to the wizard. Now that I've gotten to the end of the game, I try to get all of the lanterns—which is not always as easy as it looks.

Throughout the game you are constantly harassed by ninjas and the Green Yamo. Your joystick controls your flying kicks, karate chops, and occasional ducking to avoid the assassins' blows. You must jump and climb on vines, ladders, and moving walls that can change direction and force you into strategically placed swords. The hazards and traps that await you get worse as you get closer to the wizard's room. Electrical beams, lights streaming across the floors and exploding flames that appear from under you—all make this game one that will keep you up until the early hours of the morning.

Once you have finished the game, you start back at the beginning. This may seem a little disappointing after all you've been through, but I guess it's a compliment to the game. You hope it will never end. Once you've returned to the beginning, be prepared for a more difficult game. The ninja and Green Yamo are very annoyed at this point, and will do everything they can to stop you. I couldn't make it out of the first screen the second time.

We won't spoil the game for you by showing you too many of the rooms, but as you can see, the graphics are top notch, and the animation is very good. So put on your karate *gi*, tighten up your black belt, and prepare to do battle in **Bruce Lee**. Hiii—yaaa!□



Boot Camp

by Tom Hudson

It's hard to believe, but here we are in the seventh installment of **Boot Camp**. We've only got a few more 6502 operation codes to cover before we begin writing full-scale programs, so hang in there! The best is yet to come.

Old business.

Last issue's assignment asked you to solve eight bit-manipulation problems. You were given before-and-after bit patterns and asked to find what operation codes and operands were used to get the results. **Figure 1** shows the completed assignment. Some of the problems had two possible answers. These are so noted, with both solutions.

BYTE 1	OPN	BYTE 2	RESULT	ANS
01000011	AND	01000001	01000001	(1)
01000011	EOR	00000010	01000001	(2)
11001011	EOR	01101001	10100010	
11110000	AND	01000000	01000000	(1)
11110000	EOR	10110000	01000000	(2)
01010101	ORA	10101010	11111111	(1)
01010101	EOR	10101010	11111111	(2)
11001000	EOR	10110100	01111100	
11111111	AND	11110001	11110001	(1)
11111111	EOR	00001110	11110001	(2)
00100100	EOR	10011100	10111000	
01000111	EOR	01010011	00010010	

Figure 1.

Clever readers have probably noticed that the fourth problem actually has far more than two possible answers. In fact, by using the ORA instruction, BYTE 2 could be any value with bits 1, 3, 5 and 7 set! Try it yourself with a short program.

Simple multiplication.

As you may recall from issue 13's **Boot Camp**, by shifting a binary number left one bit, we effectively multiply it by two. Shifting it left two bits multiplies it by four. This principle is very handy, allowing us to multiply integers quickly and easily.

How do we perform this left-shift operation in 6502 assembly language? With the ASL (Arithmetic Shift Left) instruction, of course. This operation shifts the contents of the accumulator or a selected memory byte left one bit, and has the following formats:

```
ASL A     (ACCUMULATOR)
ASL nn    (ABSOLUTE)
ASL n     (ZERO PAGE)
ASL n,X   (ZERO PAGE INDEXED X)
ASL nn,X  (INDEXED X)
```

When an ASL instruction is executed, the accumulator or memory byte is shifted one bit to the left. **Figure 2** shows how the operation is handled internally.

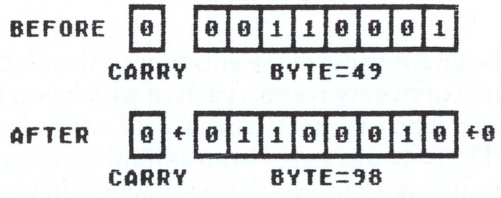


Figure 2.

As you can see from the before and after images in **Figure 2**, each bit of the selected byte is shifted to the left one place. Since bit 7 has no other place to go, it is shifted into the 6502 CARRY flag. This is done to allow for multiple-byte shifts, which we'll look at in a moment. A zero is shifted into the 1 bit. As you can see, the value of the byte has been multiplied by two!

As long as the results of your shift-multiples do not exceed 255 decimal, you will find the ASL instruction works fine. Problems begin, though, when you get into multiple-byte values.

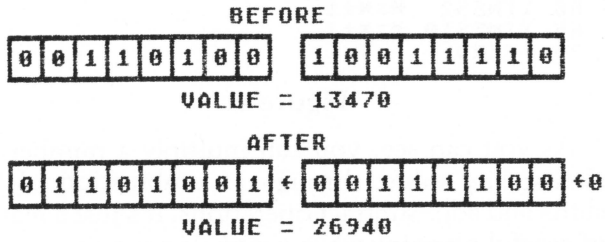


Figure 3.

Figure 3 shows an example of a multiple-byte shift. As you can see, the contents of bit 7 of the low byte must shift into bit 0 of the high byte. In order to do this, we must see the LSR instruction to shift the low byte, and a new instruction, ROL (Rotate left through carry), for the high byte. ROL has the following formats:

```
ROL A     (ACCUMULATOR)
ROL nn    (ABSOLUTE)
ROL n     (ZERO PAGE)
ROL n,X   (ZERO PAGE INDEXED X)
ROL nn,X  (INDEXED X)
```

The ROL instruction performs the same function as ASL, except that it puts the contents of the carry flag in the low-order bit instead of a zero.

Both ASL and ROL set the SIGN, ZERO and CARRY flags according to the result of the operation.

Let's look at a few examples of multiplication using the ASL and ROL instructions.

```
10  *=  $0600
20  LDA #$07      ;PLACE 7 IN ACCUM.
30  ASL A         ;TIMES 2
40  ASL A         ;TIMES 4
50  ASL A         ;TIMES 8
60  STA TIMES8    ;SAVE RESULT
70  BRK           ;AND STOP!
80 TIMES8 *=*+1
90  .END
```

Figure 4.

Figure 4 shows an example of single-byte multiplication using the ASL instruction. In this example, we're multiplying the contents of the accumulator (7) by eight and storing the result in the location labeled TIMES8.

Line 20 loads the accumulator with the number 7 (00000111 binary). You can try different values here to test the multiply. Remember that since this is only a single-byte multiple, the result cannot exceed 255. Therefore, don't use any values greater than 31 decimal here.

Line 30 shifts the accumulator to the left one bit, multiplying the accumulator by two. After this instruction executes, the accumulator will contain 14 decimal (00001110 binary).

Line 40 shifts the accumulator left another bit. At this point, the accumulator is four times the starting value of 7, or 28 (00011100 binary).

Line 50 shifts the accumulator left a third time, giving us eight times the starting value, or 56 (00111000 binary).

Line 60 stores the final value of 56 decimal ($38 hex) in the location labeled TIMES8. If you change the value in line 20, the value you enter will be multiplied by eight and placed in TIMES8.

Line 70 stops the program execution.

Line 80 reserves one byte for the result of the multiplication, labeled TIMES8.

(Continued next page)

The above example shows how easy the ASL instruction makes it to multiply a number by a power of two, but what if you want to multiply a number by five.

In such cases, it's good to break the multiplier down into "bite-sized" pieces. For example, a multiply by five can be broken down into:

```
  (number * 4)
+ (number    )
-------------
  (number * 5)
```

The 6502 code required for this operation is shown in **Figure 5**.

```
10  *=  $0600
15  LDA #23        ;PLACE 23 IN ACCUM.
20  ASL A          ;TIMES 2
25  ASL A          ;TIMES 4
30  CLC            ;CLEAR CARRY FOR ADD
35  ADC #23        ;ADD 23 = TIMES 5!
40  STA TIMES5     ;AND STORE RESULT
45  BRK            ;ALL DONE!
50 TIMES5 *=*+1
55  .END
```

Figure 5.

Similarly, a multiply by 10 can be broken down to:

```
  (number * 8)
+ (number * 2)
--------------
  (number * 10)
```

With its 6502 code shown in **Figure 6**.

```
10  *=  $0600
15  LDA #23        ;PLACE 23 IN ACCUM.
20  ASL A          ;TIMES 2
25  STA TIMES2     ;SAVE *2 VALUE
30  ASL A          ;TIMES 4
35  ASL A          ;TIMES 8
40  CLC            ;CLEAR CARRY FOR ADD
45  ADC TIMES2     ;*8 + *2 = *10!
50  STA TIMES10    ;SAVE TIMES 10
55  BRK            ;AND STOP!
60 TIMES2  *=*+1
65 TIMES10 *=*+1
70  .END
```

Figure 6.

As you can see, you can multiply a number by almost any value, through a combination of left shifts and add/subtract operations. It's just a matter of careful planning when writing a program.

Multi-byte multiplication.

Now that we've looked at single-byte multiplication, we can go on to bigger and better things, such as multiplying two-byte values. **Figure 7** shows the

procedure for multiplying the two-byte value TOTAL by sixteen. Note that the low-order byte is always SHIFTed, and the high byte is always ROTATEd.

```
10  *=  $0600
15  LDA #$02      ;PLACE 02...
20  STA TOTAL+1   ;IN TOTAL HI BYTE
25  LDA #$4F      ;PLACE 4F...
30  STA TOTAL     ;IN TOTAL LO BYTE
35  ASL TOTAL     ;SHIFT LOW,
40  ROL TOTAL+1   ;ROTATE HI = TIMES 2
45  ASL TOTAL     ;SHIFT LOW,
50  ROL TOTAL+1   ;ROTATE HI = TIMES 4
55  ASL TOTAL     ;SHIFT LOW,
60  ROL TOTAL+1   ;ROTATE HI = TIMES 8
65  ASL TOTAL     ;SHIFT LOW,
70  ROL TOTAL+1   ;ROTATE HI = TIMES 16
75  BRK           ;ALL DONE!
80 TOTAL *=*+2
85  .END
```

Figure 7.

Lines 15-30 initialize the variable TOTAL to $024F(0000001001001111) binary. Note that the label TOTAL is the low-order byte and TOTAL+1 is the high-order byte.

Line 35 shifts the low byte of TOTAL left one bit, multiplying it by two. This operation places the contents of bit 7 of the low byte in the carry flag so that it can be shifted into the high byte by the next operation.

Line 40 rotates the high byte of TOTAL left, placing the carry flag's contents in bit 0. Like the shift operation, the rotate places the contents of the high byte's bit 7 in the carry flag. After this instruction executes, TOTAL contains $049E (0000010010011110 binary), or two times the original value.

Lines 45-50 multiply TOTAL by two a second time, resulting in a value of $903C (0000100100111100 binary), or four times the original value.

Lines 55-60 multiply TOTAL by two again, giving a value of $1278 (0001001001111000 binary), or eight times the original value.

Lines 65-70 multiply TOTAL by two a final time, giving a final result of $24F0 (00100100-11110000 binary), which should be $024F*16. Checking, we find that $024F is 591 decimal. 591 times 16 is 9456 decimal, or $24F0, and our answer in TOTAL is correct.

These examples show the basics of 6502 multiplication, but don't stop here. Study the above code and try creating your own programming puzzles. I've given you the ball, now run with it!

(Continued next page.)

Divide and conquer.

Now that we've covered simple multiplication, let's look at basic division. You know how bit-shifting works, so picking up the finer points of binary division should be easy.

Remember how shifting the value 49 decimal (00110001 binary) left one bit gave us 98 (01100010 binary)? What happens if we shift the value RIGHT one bit? **Figure 8** gives us the answer.

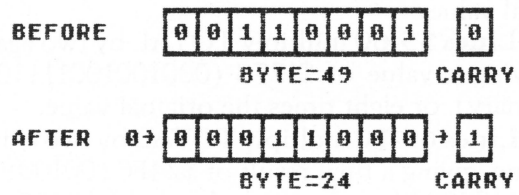


Figure 8.

As you can see, we've just discovered the first limitation of binary division — we can't handle decimals! Using real numbers instead of integers, 49/2 = 24.5. Shifting the value 49 right one bit divided it by two, all right, but we lost the decimal portion of the result. We'll look at real number division in later installments of **Boot Camp**, but for now the loss of the precision does not matter. I mentioned the problem because it's good for you to be aware of this limitation.

In the 6502 instruction set, the operation which performs this right shift is the LSR (Logical shift right) instruction. Its formats are:

```
LSR A     (ACCUMULATOR)
LSR nn    (ABSOLUTE)
LSR n     (ZERO PAGE)
LSR n,X   (ZERO PAGE INDEXED X)
LSR nn,X  (INDEXED X)
```

As **Figure 8** shows, the LSR instruction shifts all the bits of the indicated byte right one position. A zero is placed in the high-order, or 128 bit. The low-order, or 1 bit is shifted into the carry flag. This allows us to perform multi-byte right shifts, similar to multi-byte left shifts.

Before we look at multiple-byte division, let's look at a single-byte example.

```
10  *=  $0600
20  LDA #184      ;PUT 184 IN ACCUM.
30  LSR A         ;DIVIDE BY 2
40  LSR A         ;DIVIDE BY 4
50  LSR A         ;DIVIDE BY 8
60  STA DIV8      ;SAVE RESULT
70  BRK           ;AND STOP!
80 DIV8 *=*+1
90  .END
```

Figure 9.

Figure 9 shows an example of dividing a single-byte value by eight. Like multiplication by eight, this operation requires three shifts, but in the opposite direction. In this example, we divide the number 184 decimal by eight, placing the result in the location DIV8.

Line 20 places the number 184 (10111000 binary) in the accumulator.

Line 30 shifts the accumulator contents right one bit, dividing the value there by two. After this instruction, the accumulator contains 92 (01011100 binary).

Line 40 shifts the accumulator right another bit, dividing the value by two again. At this point the accumulator is divided by four, and contains 46 (00101110 binary).

Line 50 shifts the accumulator right a final time, leaving the accumulator containing the original value divided by eight. At this point it contains 23 (00010111 binary).

Line 60 stores the contents of the accumulator in the location labeled DIV8. If you examine this location after the program executes, you will see that it contains 23 decimal ($17 hex). Checking, you will find that this is 184 divided by eight.

Line 70 BREAKS the program, stopping execution.

Line 80 reserves one byte for the value DIV8.

Now you see how simple single-byte division is. If you want to divide any integer up to 255 by a power of two, this process works fine.

Shifting into high.

Up till now, we've limited ourselves to simple, single-byte division. Now let's see how we do it with more than one byte.

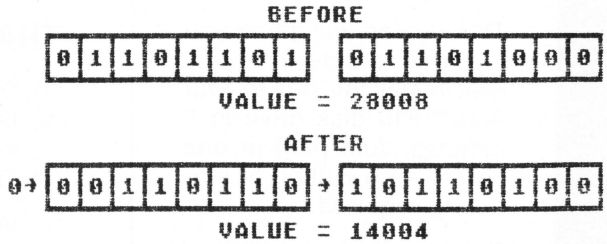


Figure 10.

Figure 10 shows the division of the two-byte value 28008 by two. As you can easily calculate, the result is 14004. If you compare this example with the multi-byte multiplication shown in **Figure 3**, you will notice an interesting difference.

In multiplication, the LOW byte is shifted and the HIGH byte(s) is (are) rotated. This is because the bit shift proceeds from right to left.

In division, however, things are reversed. Since we are shifting all the bits to the right, the HIGHEST byte is shifted, and the remaining bytes are rotated. This allows the low-order bits of the bytes being

divided to shift into the lower-order bytes.

Let's look at an example of the three-byte value SCORE being divided by four. The code necessary is shown in **Figure 11**.

```
10  *=  $0600
15  LDA #$49      ;SET UP...
20  STA SCORE+2   ;3-BYTE...
25  LDA #$23      ;VALUE...
30  STA SCORE+1   ;IN SCORE...
35  LDA #$F8      ;= $4923F8
40  STA SCORE
45  LSR SCORE+2   ;DIVIDE...
50  ROR SCORE+1   ;SCORE...
55  ROR SCORE     ;BY 2
60  LSR SCORE+2   ;DIVIDE...
65  ROR SCORE+1   ;SCORE...
70  ROR SCORE     ;BY 4
75  BRK           ;AND STOP!
80 SCORE *=*+3
85  .END
```

Figure 11.

Lines 15-40 initializes the three-byte value SCORE to $4923F8. Remember that multi-byte values are always stored in low byte-high byte order. In this case SCORE is the lowest-order byte and SCORE+2 is the highest-order byte.

Line 45 SHIFTS the highest-order byte of SCORE right one bit. The 1 bit of SCORE+2 is placed in the carry flag, ready to be ROTATED into the next byte of SCORE.

Line 50 ROTATES the middle-order byte right one bit. The bit carried from the highest-order byte is shifted into SCORE+1's 128 bit, and the 1 bit of SCORE+1 is placed in the carry flag for the next ROTATE.

Line 55 ROTATES the low-order byte of SCORE right one bit. Once again, the carry status is placed in the 128 bit, and the 1 bit is shifted into the carry. This final carry is not used, but is ignored. After this instruction executes, the value in SCORE is divided by two, and contains $2491FC. You can calculate the binary and decimal values as an exercise.

Lines 60-70 perform the same function as Lines 45-55, leaving SCORE with the original value divided by four, or $1248FE. Calculate the decimal and binary values for this result, and you will see that the original value has been divided by four.

Line 75 BREAKS the execution of the program. At this point, you can examine the three bytes of SCORE and see that they contain the proper result.

Line 80 reserves three bytes for the variable SCORE.

Well, now you have the basics of integer binary multiplication and division under your belt. The principle is simple, you just have to work with it until you feel comfortable. In order to do that, create your own problems to solve. If you run into difficulty, write me and I'll help out. After all, you may not be the only person with a particular question, and your query could help others understand more, too.

Here it comes.

For those of you who need some prompting to get started with problems, here's one that shouldn't be too hard if you've read carefully.

Write a program that multiplies the value 5 by 27. Use any of the techniques we have discussed so far. There are several possible solutions to this problem, so give it your best shot. When you solve it, I'd like to see the technique you used. Send listings of your solutions to:

Boot Camp
c/o ANALOG Computing
P.O. Box 23
Worcester, MA 01603

Next issue, we'll look at a couple of possible solutions. We'll also find out what the stack is and how it helps us write subroutines. □

So, you want to be a SYSOP?

by Noel & Kim Thomas

After seeing the movie *War Games*, we ran out and bought our first modem — an Atari 830 Acoustic. We soon found out that there were no local Atari Bulletin Board Systems (BBS). So, we took to the long-distance phone lines to locate Atari BBS's.

It wasn't long before my wife, Kim, wanted to be a system operator (Sysop) of her own bulletin board. After many calls to various boards, we found one that had an AMIS Bulletin Board program that we could download. No documentation was provided, although all the required programs were available. These consisted of: 1) the bulletin board program, 2) the message-base initialization program, 3) the message-base compactor program, and 4) the message-base expansion program.

Well, we had a modem and a program — now what?

After a few hours of examining the program, Kim decided what files were going to be necessary. The next step was to create each text file and run the initial program in order to set up the sectors for the messages, since we were just starting out.

The first text file to be created was the Welcome message. This is the first file the caller sees, so we had to think of a good name. After some thought we decided on the name S.P.A.C.E. It's an acronym for St. Petersburg Atari Computer Enthusiasts. This enabled us to incorporate a theme for the board patterned after the space shuttle.

Text files are constructed using a word processor. We found that **Text Wizard** by DataSoft proved to be the best, because it allows the use of inverse characters. The other text files that were created include:

Bulletins — Contain brief facts of interest, for sale, etc.

File Directory — Contains a list of current programs for download.

Help — Explains commands used in depth for new users.

Information — Tells a little about the BBS and the equipment used.

Joke — The weekly joke.

Member Log — A listing of all Board Members, their phone # and computer type.

Board Pass — Explains the password system to the new users.

Passfile — A file that contains the user's password, name, address, phone #, time limit and computer type code.

Other Boards — A list of other BBS's broken up into Atari & non-Atari.

Visit Library — The file that contains all the Public Domain software available from this BBS. The file is broken down into six sections: (Games, Music, Educational, Communication, Utilities, and Graphics).

Function — File containing the brief summary of the command list.

Zero-Gravity — This file includes game tips, programming tips and other Atari related topics.

This was the most time-consuming portion of the BBS set-up. Now that we had the message sectors allocated and the text files created, our work disk was finished, and we were ready for a trial run online.

The first two weeks we were running the board using an acoustic modem. This became a little tiresome, since it required using "ringback." A person would call, let the phone ring once, then call right back. We would then wait for the second ring and put the phone on the modem. Needless to say, as the calls increased, we soon grew tired of this and purchased a Hayes Smartmodem 300. (See a review of the Hayes Smartmodem 1200 on p.17.) Next came the dedicated phone line which let us expand our hours of operation.

After some experimentation we set the pins on the Smartmodem as follows:

Pin Number		Setting
DTR	1	UP
VERBOSE	2	UP
QUIET	3	DOWN
ECHO	4	UP
RING	5	UP
CARR. DET.	6	UP
RJ11	7	UP
NOT USED	8	DOWN

The modem cable was wired as follows:

Modem Pin		850 (RI)
Transmit Date	2	3 SEND(OUT)
Receive Data	3	4 REC.(IN)
Ground	7	5 GROUND
Carrier Detect	8	2 CRX(IN)
Data Ter. Rdy	20	1 DIR(OUT)
Ring Indicator	22	6 DSR(IN)

With the auto-answer modem, the SPACE BBS was off to a flying start.

We now began to find out about the daily work involved in being a Sysop. Each day there are passwords to add and backups to make of the work disk. Since we only selected 200 sectors for our messagebase, we needed to use the compactor program about every 2 weeks. Soon it will be necessary to use the expansion program and increase the sector allocation for messages to 300 or more. The bulletins need to be updated, and the download files rotated on a weekly basis. Many hours are spent in the evenings chatting directly with the callers and answering their questions.

As you can see the Sysop's activities are many, but there are rewards, too. We have met hundreds of people through the BBS and have made many new friends. We have callers from all over the country, including one from Texas named Bugs Bunny!

Required hardware.

The hardware necessary to run your own BBS is:

An Atari 400 or 800 with 48K
At least 1 Disk Drive
Atari 850 Interface
Printer
Modem (preferably Hayes Smartmodem 300)

The SPACE BBS runs on an Atari 400 with 48K, with an Inhome B-Key Keyboard, two 810 drives, Hayes Smartmodem, 850 interface, and an Atari 820 printer.

BBS commands.

All bulletin boards have a list of commands that allow the caller to select which area to access. Since the theme of our BBS is a flight in space on a shuttle, commands are listed as your "Control Panel." The following commands can be found at the Control Panel:

Command	Function
A	**Toggles Atascii/Ascii mode**
B	**Bulletins**
C	**Chat with Captain**
D	**Download Files**
E	**Enter Message**
F	**Files Available for Download**
G	**Goodbye/Logoff**
H	**Help with Commands**
I	**Information on Shuttle**
J	**Joke Corner**
L	**Toggles Linefeeds**
M	**Member Log**
N	**New User Password Application**
O	**Other BBS List**
P	**Private Message to Captain**
R	**Retrieve Messages**
S	**Summary of Messages**
T	**Time Remaining on this Flight**
U	**Upload Files**
V	**Visit Atari Download Library**
W	**Welcome Message**
X	**Expert User Mode**
Y	**Lists Local BBS**
Z	**Zero-gravity Chamber**
?	**Lists Functions**

Common problems.

A common problem of Sysops is the board crasher. The Atari BBS software is unique in that the program is virtually "crash-proof." This is because, when the interface channel is opened in concurrent mode, no other input/output operations that use the computer I/O connector can be performed. This means that no peripheral, other than the keyboard and the screen editor, can be accessed while the modem channel is open. Some Apple boards are not so lucky, due to the fact that the knowledgable "hacker" can get into the disk drive and even erase BBS files!

Of course, there is the problem of the callers who leave abusive messages on the board. By installing a "Password Only" message base, you can eliminate this from your system.

The weather can also be a foe of the Sysop. A thunderstorm can cause hundreds or even thousands of dollars of damage to your equipment. We recommend that the system be completely shut down during periods when lightning is expected.

Other considerations.

There are a few important questions that should be considered before starting your own Bulletin Board Service.

First, can you manage without your computer system, since running a BBS will tie up your equipment? You will be surprised at how much you miss working on the computer or playing games! Two complete systems allow you to have the "best of both worlds."

Second, are you ready to install another telephone line to be "dedicated" to the BBS or will the board keep your telephone busy for hours? The second phone line will entail some amount of additional expense on your part.

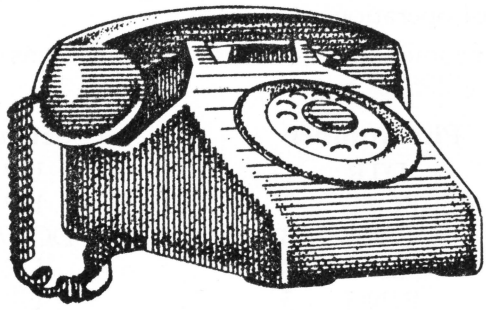
Third, are you prepared to spend 1 or 2 hours a day just for "housekeeping" duties for the board? The updating and backup routines are important parts of keeping a BBS running smoothly.

Finally, remember that a good BBS is a dependable BBS. Using your equipment for 12 to 24 hours a day may require more equipment upkeep than usual. If the system does "go down" for repairs will you be able to get it fixed and running again quickly?

In conclusion.

Those of you who answered "yes" to the previous questions may have the makings of a Sysop.

Anyone who would like the software to start their own Atari BBS can call the S.P.A.C.E. Board at 813-344-3321 during Flight Hours (noon to midnight). Happy "modeming!" □



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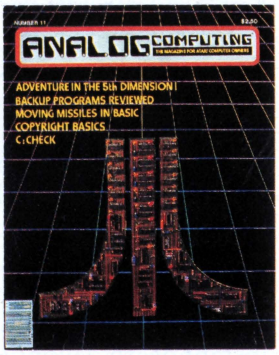

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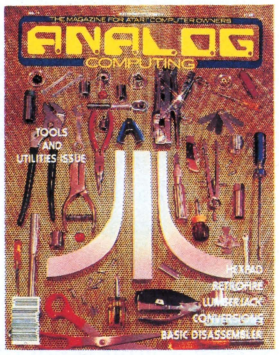

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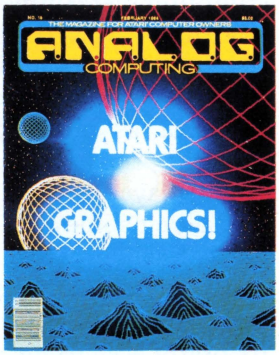

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MiG ALLEY ACE
MICROPROSE SOFTWARE
18616 Beaver Dam Road
Hunt Valley, MD 21030
$34.95

by Patrick Kelley/Pilot, North Korean Air Force

Streaking through the cloudless skies in my MiG-15 fighter, I can't help but feel a certain amount of pity for my opponents today and the fate they will soon meet. The blanket of air superiority is ours: from north of the Yalu river to over 100 miles into Korea no aircraft can challenge us. In the area the American fliers call "MiG Alley" we are invincible. We are the undisputed masters of the sky. Today will be no different. My pulse quickens as I see a flash of sunlight gleaming off metal in my rear mirror, and I roll to meet it. As I increase throttle to my MiG's engine the distance between us narrows. It is an American aircraft, escorted closely by his wingman. Smiling grimly, I arm my cannon and ready myself for battle. We will clash at close to the speed of sound, and the slightest miscalculation will mean instant death. I wonder what my enemy is thinking as I lower my helmet visor.

If this sounds to you like the stuff from which exciting computer games could be made, consider it already done. **MiG Alley Ace**, the new combat/-flight simulator from MicroProse Software, *is* exciting. In **MiG Alley Ace** you can select any number of computer-determined scenarios taken from the Korean air war. You can play them out either in a co-operative mode with another player as squadron leader and wingman against a computer controlled MiG, or as pilot against pilot in a one-on-one dogfight.

The playability and controls of the game are excellent, albeit somewhat touchy in the targeting department. Even an armchair pilot like myself found it a cinch to pull off rolls, dives, loops and even a few messy split "s's" without slamming into the ground. Its pretty easy to imagine the G-forces pressing you into your couch as you put your plane through its paces, and you almost wish you had a pressure suit to force the blood back into your extremities after you pull yourself out of a flat spin. The graphics are a bit on the crude side —but have a certain imagination behind them. (For example, as you take your plane away from the area of the sky where the sun is on the day combat mode, a crescent moon fills the sky.)

For novices this game will be a bit intimidating the first time you take joystick in hand, but it will provide lots of thrills once you master a few of the basics. I myself like playing the co-op mode where you engage the computer-controlled aggressor, instead of playing mano a mano with publisher Lee Pappas (a pilot in real life.) I have a pointer for potential MiG Alley Aces — watch your altimeter gauge! Many a good battle was cut short when yours truly wasn't watching his altitude and took his plane into a 700 MPH rendezvous with the ground, a maneuver not endorsed by the USAF Flight Training School. If you have a forgiving friend or tolerant enemy the one-on-one mode can't be beat. Otherwise, you'll just have to take it the hard way and go against the computer (not a good confidence builder!) to earn the title of **MiG Alley Ace.** □

MiG Alley Ace.

by Lee Pappas/Captain, U.S.A.F.

Another day, another strike. When will those Reds learn that Americans aren't trained to fly — we're born to fly. It almost seems unfair as I pour steel-jacketed slugs into my adversary. Then I remember that Pat Kelley is my co-worker and friend, and I sure feel terrible (with a glint in my eye) as I blast him out of the blue.

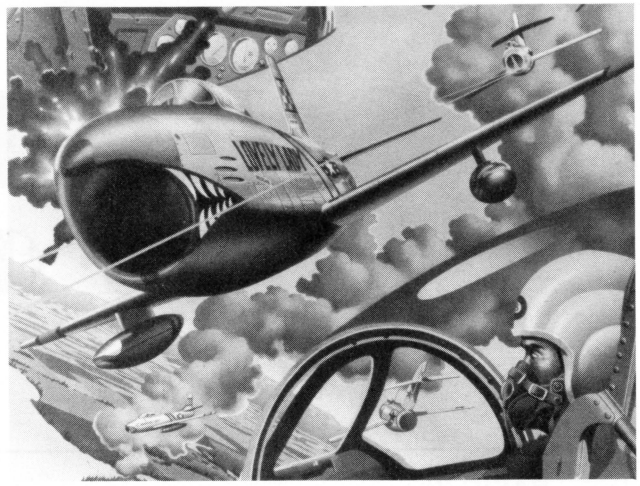
MiG Alley Ace is a must-have for any Atari game fanatic. Split in two parts, the upper half of your screen is your point of view, and the lower half your opponent's. In one-player mode (you vs. the computer) the lower half shows the computer's "over the panel" view. A small readout under each viewpoint shows altitude, velocity, number of ammo rounds and power setting. A "rearview" mirror assists in spotting enemy aircraft on your tail.

Player(s) One control(s) the gray planes, Player Two (or the computer) flies the orange. The aircraft can roll, dive, crash, explode and shoot. They also vary in size depending on distance, and a plane will be shown in respect to its opponent's altitude. In other words, if you're taking your F-86 Sabre into a steep climb, it'll appear that way on your opponent's lower

screen half. The same is true whether you're diving, looping or doing other maneuvers. With an increased power setting, you can climb to heights in excess of 30,000 feet and do such fancy aerobatics as looping and crazy-8's, but watch that altitude or you'll meet Mr. Ground. Observers of the Pappas/Kelley battles have been known to scramble out of the office in search of Dramamine.

It takes several hits to down an enemy plane. When your rounds come into contact with your opponent's plane, it will glow red for a second. After several hits he'll lose power entirely. With a few more shots he'll never even have a chance to bail out (CONTROL Q) before his plane explodes. There have been rare occasions where I've had enough altitude to glide powerless long enough to seek revenge on my enemy, thus making him crash first, giving me the points he might have received.

The game has a few occasional graphic bugs: some screen glitches (understandable, considering how much is going on), the sun passing in front of the ground, and the moon not changing angle when the horizon does. However, these aren't major, and most people wouldn't even notice them. One minor quirk: even though the MiG-15 and the F-86 Sabre aren't exactly state-of-the-art aircraft by today's standards,



they *are* jets. Anyone listening to **MiG Alley Ace** will quickly notice that the planes sound prop-driven (ala the movie *Airplane*!)

MicroProse has another great flying scenario on their hands (they also wrote **Solo Flight**), and this game should have you on the edge of your seat. And, as in my case, you may even reach a point where no one will play with you (even with the small bullet handicap) because you have truly struck fear into their hearts! □

SUPERBASIC
for the Atari

BASIC XL
OPTIMISED SYSTEMS SOFTWARE
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San Jose, CA 95129
(408) 446-3099
16K Cartridge $99.00

by Robert L. Riggs

Optimised Systems Software (O.S.S.) has done it again! Bill Wilkinson & Co. have put the cap on the BASIC language for Atari computers: **BASIC XL**. It's neatly wrapped and documented in a yellow binder which accompanies the bright orange cartridge.

The documentation begins with a 176-page tutorial entitled "30 Days to Understanding BASIC XL," written by Bill Wilkinson and Diane Goldstein. If you are a complete novice at BASIC programming, this book and a fair amount of determination are all you will need to learn to use your Atari computer. Bill and Diane introduce you to BASIC XL with the "chapter-a-day" system: 30 chapters, beginning with "Getting to know your computer" and extending through "Congratulations: 30 END."

Following the tutorial is the reference manual which documents the entire language, including 45 syntax expressions and keywords not found in 8K Atari BASIC. It's a well-known fact that Bill Wilkinson was part of the team that developed 8K Atari BASIC. He's written more than once of the bugs and limitations inherent in that language. **BASIC A+** did much to alleviate those shortcomings, but it was disk-based and devoured too much memory. **BASIC XL** is on cartridge and, because of its memory bank design, uses no more RAM than Atari BASIC. Critics of the execution speed of other versions of BASIC will find little to complain about with regard to O.S.S.'s latest achievement. BASIC programs previously typed in from magazines — and abandoned because of their boring snail-pace — run at arcade speeds with **BASIC XL**. In fact, timing loops almost invariably have to be extended when running Atari BASIC programs with **BASIC XL**. That's right, **BASIC XL** is upward compatible with Atari BASIC, unlike MicroSoft BASIC. And it still offers MicroSoft-style string-handling, auto line-numbering, renumbering and line delete.

Other useful additions to the BASIC vocabulary include ELSE, WHILE, ENDIF, ENDWHILE, PRINT USING, TAB and TRACE/TRACEOFF. Player-missile graphics are of particular interest to many Atari programmers. Dozens of articles and programs in a variety of books and magazines are devoted to utility programs to help you design and use players and/or missiles. O.S.S. provides you with BASIC commands to deal with these pesky critters. Just wait until you can use commands like MISSILE, BUMP, PMCOLOR, PMGRAPHICS, PMMOVE, PMWIDTH and PMCLR. You'll love it! SET is another new and extremely powerful command. It allows you to exercise control over a variety of system level functions. You can quickly and easily change 13 functions such as BREAK key enable/disable, Tab stop settings for the comma in PRINT statements, the prompt character for INPUT, auto DIMensioning, and LIST formatter to automatically indent structured statements. DOS commands directly from BASIC include DIR (disk directory), ERASE, PROTECT, UNPROTECT and RENAME.

And that's not all. You get additional functions like DPEEK/DPOKE, ERR, FIND, HSTICK/VSTICK, PEN, PMADR and SYS. You can type them all in caps, lower case or even reverse characters for all **BASIC XL** cares. Just think — no more angrily hitting the CAPS/LOWR key after a syntax error!

Yes, I know that doesn't add up to 45 commands, yet. There are more advanced-technique keywords that some of you will undoubtedly drool over, so I suggest that you run (don't walk) directly to your friendly Atari dealer and buy your very own copy of **BASIC XL** immediately. It's the here-and-now solution to all your BASIC needs for your Atari computer. □

Default

by Charles Bachand

I hate things that are monotonous. Blue screens, white letters and black backgrounds are just too much for this 'ole programmer's eyes to take, day after day. Wouldn't it be nice to be different once in a while?

Changing one's screen color is a very simple thing to do. Just typing SETCOLOR 2,12,4 in immediate mode gives you a nice shade of dark green to stare upon for the rest of the day (or at least until you press SYSTEM RESET). Then you're back to the same old blue screen! That is, unless you use the following utility. **Default**, to set up your new color scheme. When SYSTEM RESET is now pressed, the colors will return to the ones you have chosen.

Default can be customized to add or delete such options as screen margins or character set addresses just by adding or deleting DATA statements at the end of the program. DATA statements are entered as a decimal address of the option byte. A string then describes the option. Examples to set up the left and right screen margins follow:

```
500 DATA 82,Left Margin
510 DATA 83,Right Margin
```

If you don't wish to change an option when the program prompts you to enter a new value, simply type a carriage return at the prompt, and the option will be skipped. This program will also work with either cassette or disk-based computer systems.

A word to the wise: After running **Default** and setting up your new colors, margins or whatever, do not run it again. The computer will probably lock up and go into never-never land. If you wish to change your options again, reboot the system and start from scratch. □

```
100 REM Defaults by Charles Bachand
110 REM
130 DIM TEXT$(20):ADDR=1664
135 PRINT "{CLR}{DOWN}DEFAULT RESETTER":PRINT
140 TRAP 300:READ LOC,TEXT$
150 PRINT :PRINT " Option: ";TEXT$
155 BYTE=PEEK(LOC)
160 PRINT :PRINT " Default: ";BYTE,
170 PRINT " New Value: ";
180 TRAP 190:INPUT NVAL:BYTE=NVAL
185 IF BYTE<0 OR BYTE>255 THEN PRINT :
PRINT " OUT OF RANGE! ":GOTO 150
190 POKE ADDR,169:POKE ADDR+1,BYTE
200 POKE ADDR+2,141:HI=INT(LOC/256)
210 POKE ADDR+3,LOC-HI*256
220 POKE ADDR+4,HI:ADDR=ADDR+5:GOTO 14
0
300 POKE ADDR,76:POKE ADDR+1,PEEK(12)
320 POKE ADDR+2,PEEK(13)
330 IF PEEK(9)=0 THEN POKE 9,1:POKE AD
DR,96
340 POKE 12,128:POKE 13,6:PRINT
350 PRINT "{UP}PRESS SYSTEM RESET TO EN
ACT CHANGES":NEW
400 REM address label
420 REM ------- -----
500 DATA 82,Left Margin
510 DATA 83,Right Margin
520 DATA 708,Setcolor 0
530 DATA 709,Setcolor 1
540 DATA 710,Setcolor 2
550 DATA 711,Setcolor 3
560 DATA 712,Background color
```

•

CHECKSUM DATA

(See page 21)

```
100 DATA 53,77,409,409,832,152,589,726
,740,778,741,729,429,294,221,7179
300 DATA 939,219,654,35,635,700,340,62
8,8,446,453,453,460,944,6914
```

•

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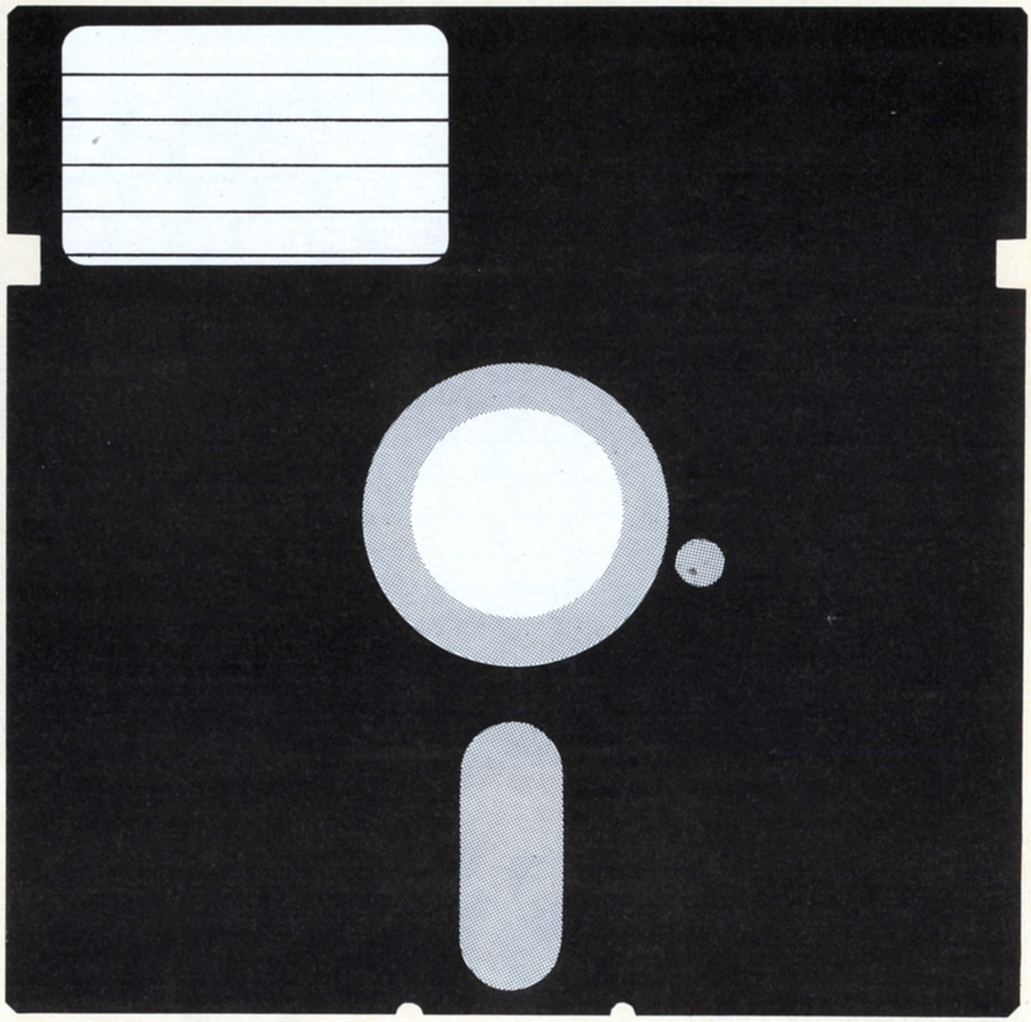

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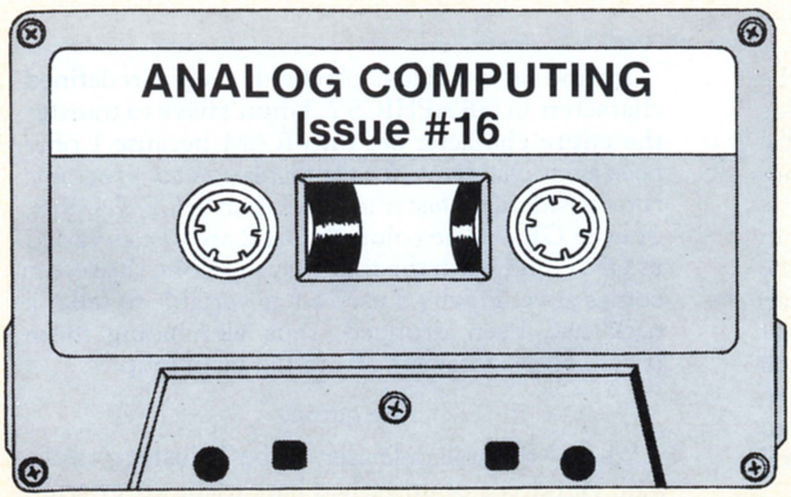

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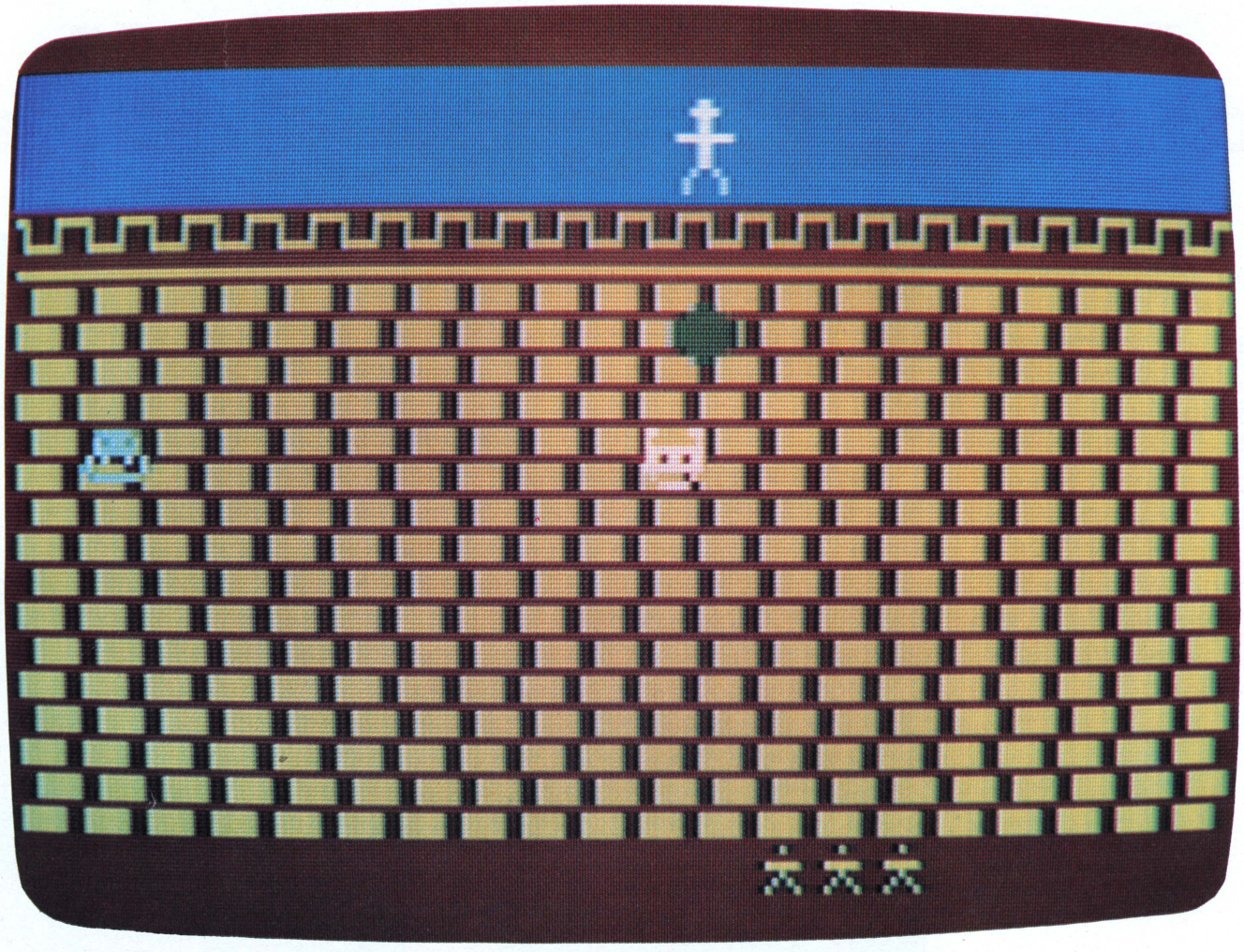


Siege

16K Cassette 24K Disk

by Glen Raffel

Arcade quality games don't necessarily have to be written in machine language. BASIC still holds opportunity for fast-paced games with colorful graphics. **Siege** contains several time-saving routines that speed up the action.

The player/missile graphics are contained in strings. By overlapping the string memory and the player/missile memory, you can use the quick Atari string commands to move the players. However, that only takes care of vertical motion. For horizontal motion, I wrote a short machine language program to read the joystick and move the player from side to side. This routine also eliminates the need for several time-consuming IF. . . THEN statements.

Instead of a normal playfield, I used redefined characters in GRAPHICS 2. I didn't have to transfer the entire character set into RAM because I only need a few characters for the display. Also, programs run considerably faster in GR.2 than in GR.7, GR.8, or even GR.0. The colors in GR.2 are just as varied as GR.7, and, with the four player colors, the screen comes alive. Finally, I used a flag variable to tell if a rock had been dropped, thus eliminating more IF. . . THEN statements from the main loop.

The game.

You are the sole defender of the Trausberg castle wall. Hundreds of unwashed barbarians are swarm-

ing at the base of the wall. They are scaling the walls in a desperate attempt to invade the castle. Fortunately, you are equipped with an enormous supply of boulders, which you can drop on their heads to stave off their vicious assault.

You can move your man across the screen with the joystick. The trigger button releases the boulders. You start with three men, and your remaining men are displayed in the lower right corner of the screen. The START button begins the game. At first the game might seem easy, but after each round the barbarians move even faster. The fate of Trausberg is in your hands... □

Variable Table

A	Dummy variable
A$	Sky characters
B	Location of character set
BASE	Hi Byte of new character set
BOMB$	Shape of the bomb
BOMBY	Y position of bomb
C$	Wall top characters
D$	Start of P/M memory
E	Loop variable
E$	Brick characters
F$	P/M buffer
FL	Bomb drop flag
L	Level
M$	Missile memory
MAN$	Shape of man
MANX	X position of man
MANY	Y position of man
MEN$	No. of remaining men
PO$, P1$, P2$, P3$	Respective player memory
PM$	Beginning of P/M memory
S1$	First monster shape
S2$	Second monster shape
S1X	First monster x position
S2X	Second monster x position
S1Y	First monster y position
S2Y	Second monster y position
T	Loop variable
V	X position of bomb
X	Timing loop
Z	Rate of ascent

BASIC Listing.

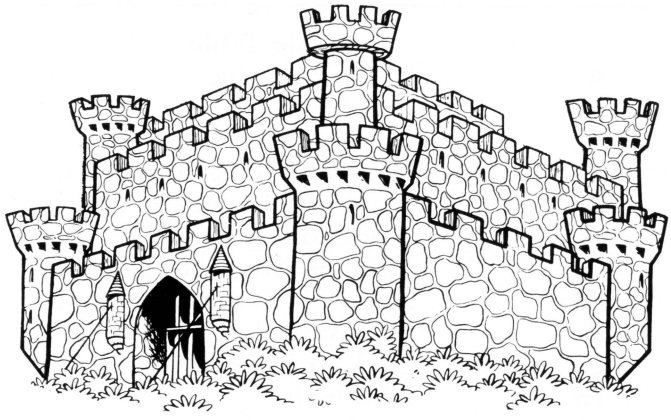
```
1 GOSUB 1000
2 GOSUB 1400
3 A=USR(1536):P1$(S1Y)=S1$:P2$(S2Y)=S2
$
4 S1Y=S1Y-Z:S2Y=S2Y-Z:IF S1Y<22 OR S2Y
<22 THEN 2000
5 IF FL=1 THEN 30
6 IF STRIG(0)=0 THEN FL=1:V=PEEK(1790)
7 GOTO 3
30 BOMBY=BOMBY+2:POKE 53251,V:IF BOMBY
>120 THEN BOMBY=25:FL=0:SOUND 0,0,0,0:
GOTO 3
31 IF PEEK(53261)>0 OR PEEK(53262)>0 T
HEN SOUND 0,0,0,0:FL=0:POKE 53279,9:GO
TO 50
32 P3$(BOMBY)=BOMB$:SOUND 0,BOMBY+50,1
0,4:POKE 53278,9:IF SC>L*200 THEN 3000
33 GOTO 3
50 SC=SC+10:IF PEEK(53262)>0 THEN 60
51 FOR T=15 TO 0 STEP -1:FOR E=1 TO 5:
NEXT E:SOUND 0,20,2,T:NEXT T
52 FOR T=S1Y TO 95:P1$(T)=S1$:NEXT T:S
1Y=95:S1X=RND(0)*150+50:POKE 53249,S1X
:BOMBY=25:P3$=M$
53 POKE 53278,9:GOTO 3
60 FOR T=15 TO 0 STEP -1:FOR E=1 TO 5:
NEXT E:SOUND 0,40,2,T:NEXT T
61 FOR T=S2Y TO 95:P2$(T)=S2$:NEXT T:S
2Y=95:S2X=RND(0)*150+50:POKE 53250,S2X
:BOMBY=25:P3$=M$
62 POKE 53278,9:GOTO 3
999 REM *** TITLE PAGE ***
1000 GRAPHICS 2:POKE 756,226:SETCOLOR
0,0,0:SETCOLOR 2,0,0:? #6:POKE 752,1
1010 ? #6;"                    "
1020 ? #6;"  SSSS  IIIII  EEEEE  GGGG  EEEEE  "
1030 ? #6;"  S       I    E      G     E      "
1040 ? #6;"  SSSS    I    EEEE   G GGG EEEE   "
1050 ? #6;"     S    I    E      G   G E      "
1060 ? #6;"  SSSS  IIIII  EEEEE  GGGG  EEEEE  "
1070 ? "                by  Glen Raffel"
1080 T=T+1:IF T=16 THEN T=0
1090 SETCOLOR 1,T,10:IF PEEK(53279)=6
THEN 1200
1100 GOTO 1080
1199 REM *** CHAR. SET ***
1200 BASE=PEEK(106)-8:B=BASE*256
1210 FOR T=3 TO 6:FOR E=0 TO 7:READ A:
POKE B+T*8+E,A:NEXT E:NEXT T
1220 DATA 0,63,63,63,0,252,252,252,0,1
99,68,68,124,0,0,255,0,16,0,124,16,40,
68,0,255,255,255,255,255,255,255,255
1229 REM *** P/M GRAPHICS ***
1230 GRAPHICS 2+16:DIM D$(1),F$((INT(A
DR(D$)/1024)+1)*1024-ADR(D$)-1),PM$(38
4),M$(128),P0$(128),P1$(128)
1240 DIM P2$(128),P3$(128):PM$=CHR$(0)
:PM$(384)=CHR$(0):PM$(2)=PM$:M$=PM$:P0
$=M$:P1$=M$:P2$=M$:P3$=M$
1250 DIM MAN$(14),S1$(11),S2$(11),BOMB
$(13)
1260 FOR T=1 TO 14:READ A:MAN$(T,T)=CH
R$(A):NEXT T:FOR T=1 TO 11:READ A:S1$(
T,T)=CHR$(A):NEXT T
1270 FOR T=1 TO 11:READ A:S2$(T,T)=CHR
$(A):NEXT T:FOR T=1 TO 13:READ A:BOMB$
(T,T)=CHR$(A):NEXT T:POKE 623,1
1280 DATA 0,24,60,24,24,255,24,24,24,3
6,66,66,0,0
1290 DATA 0,0,60,90,126,165,129,126,0,
0,0
1300 DATA 0,0,195,129,255,219,255,66,6
0,0,0
1310 DATA 0,0,0,24,126,255,255,255,126
,24,0,0,0
1320 POKE 54279,ADR(PM$)/256:POKE 559,
46:POKE 53277,3
1330 POKE 704,14:POKE 705,202:POKE 706
,58:POKE 707,227
1350 FOR T=1536 TO 1536+38:READ A:POKE
 T,A:NEXT T
1360 DATA 104,173,120,2,201,7,208,14,1
73,254,6,105,2,141,254,6,141,0,208
1370 DATA 76,37,6,201,11,208,11,173,25
4,6,233,2,141,254,6,141,0,208,96,0
1380 POKE 1790,120:RETURN
1399 REM *** INIT ***
1400 DIM A$(20),C$(20),E$(20),MEN$(6):
A$="$$$$$$$$$$$$$$$$$$$$":C$="########
##################"
1410 SC=0:MEN=3:MEN$="     ":L=0:POKE
19,0:E$="####################":Z=0.4
1419 REM *** SET UP ***
1420 POKE 87,0:? "K":POKE 756,224:POKE
 87,2:L=L+1:Z=Z+0.08
1430 POSITION 6,4:? #6;"WAVE ";L:POSIT
ION 6,6:? #6;"SCORE ";SC
1440 FOR T=1 TO 6:FOR E=80 TO 99:POKE
708,14:SOUND 0,E,10,8:NEXT E:SOUND 0,0
,0,0:POKE 708,0:FOR E=1 TO 20
1450 NEXT E:NEXT T
1460 POKE 708,15:FOR T=30 TO 0 STEP -1
:FOR E=1 TO T:NEXT E:POKE 53279,0:NEXT
 T
```

```
1470 MANX=120:MANY=20:S1Y=95:S2Y=95:BO
MBY=25:BOMBX=MANX:S1X=RND(0)*150+50:S2
X=RND(0)*150+50
1480 POKE 756,BASE:FOR T=10 TO 3 STEP
-1:POSITION 0,T:? #6;C$:NEXT T:POSITIO
N 0,2:? #6;A$
1490 POKE 712,34:POKE 708,24:POSITION
0,0:? #6;E$:POSITION 0,1:? #6;E$
1500 POKE 53248,MANX:POKE 53249,S1X:PO
KE 53250,S2X:P0$(MANY)=MAN$:P1$(S1Y)=S
1$:P2$(S2Y)=S2$
1510 FOR T=1 TO MEN:MEN$(T,T)="%":NEXT
 T:POSITION 12,11:? #6;MEN$
1520 POKE 53278,9:POKE 1790,120:RETURN
2000 FOR T=20 TO 120:SOUND 0,T+50,10,8
:P0$(T)=MAN$:NEXT T:SOUND 0,0,0,0
2010 S1Y=95:S2Y=95:FOR T=15 TO 0 STEP
-1:SOUND 0,50,0,T:FOR E=1 TO 15:NEXT E
:NEXT T
2020 MEN=MEN-1:IF MEN=0 THEN 5000
2030 MEN$=M$:FOR T=1 TO MEN:MEN$(T,T)=
"%":NEXT T:POSITION 12,11:? #6;MEN$:P0
$=M$:P0$(MANY)=MAN$:P1$=M$:P2$=M$
2040 FL=0:POKE 53278,9:GOTO 3
3000 FOR T=0 TO 3:POKE 53248+T,0:NEXT
T:P0$=M$:P1$=M$:P2$=M$:P3$=M$
3010 SOUND 0,0,0,0:GOSUB 1420
3020 FL=0:GOTO 3
5000 POKE 756,224:POKE 87,0:? "R":POSI
TION 6,0:? "GAME over":FOR T=1 TO 4:PO
SITION 0,0:? "D"
5010 FOR E=1 TO 50:NEXT E:NEXT T:POKE
87,2:POSITION 6,6:? #6;"SCORE ";SC
5020 IF PEEK(53279)=6 THEN FOR T=0 TO
3:POKE 53248+T,0:NEXT T:RUN
5030 X=X+1:IF X=255 THEN X=0
5040 POKE 708,X:GOTO 5020
```

CHECKSUM DATA

(See page 21)

```
1 DATA 632,642,714,613,158,813,138,987
,800,486,365,447,413,317,70,7595
60 DATA 414,320,69,792,990,59,576,313,
540,479,91,571,480,614,715,7023
1199 DATA 539,927,383,568,701,79,443,9
43,793,349,381,276,800,868,129,8179
1330 DATA 343,443,456,453,238,668,929,
600,354,190,735,797,501,595,757,8059
1480 DATA 31,495,485,143,879,437,370,2
11,538,616,198,450,353,14,187,5407
5020 DATA 286,669,341,1296
```



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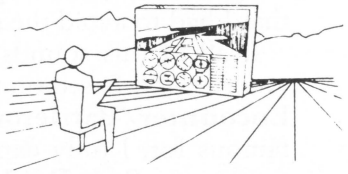

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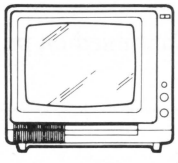

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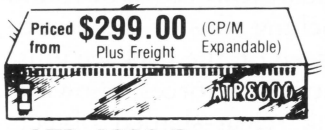

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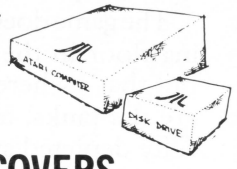

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DIMENSION X
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by Robert T. Martin

After more than nine months of waiting, Synapse Software has finally given birth to a game that its advertisements led me to believe was going to be the game of the century. The ad read, "What has immeasurable fire power — attacking Rigillians — altered perspective scrolling — and no mercy?" **Dimension X** is finally here, but it is not exactly what I expected.

The game does feature an altered perspective scrolling floor in the playfield, which is very attractive, but that's where the fun ends. Nowhere to be found are the tanks, missile-launching silos or the beautifully depicted spaceships seen on the package illustration. Instead, the only attacking forces, known as Rigillians, are small, pink, cigar-shaped objects which are unusually easy to shoot down. Gone is the separate-screen 64 sector map showing what type of enemy is where, and how much fuel it takes to get there. We now have a 25 sector grid showing how many enemies are in each sector that is combined with an omni-present screen displaying a limited number of vital functions. In fact, neither of the two screen photographs shown on the packaging ever made it to the game intact.

The game opens with you viewing a mountainous horizon, with what appears to be a checkerboard field between you and the mountains. You are looking through the window of a cockpit that has the aforementioned desert map, a display showing shield and fuel status, a readout showing the distance between you and the Rigillians, a radar screen, and a communications window which gives you various messages throughout the game. A push of the joystick starts the field scrolling, and, by manipulating the stick, you realize that you are in a bowl (or pie tin) with mountains forming the perimeter. The object of the game is to rid this sector of Rigillians by blasting them, and then moving via one of eight passageways through the mountains to another sector for resumed Rigillian blasting. The eight passageways correspond to the basic compass points, and the desert map reveals which sectors you will arrive at by travelling through the various passageways.

Upon entering a passageway, you realize that a great deal of imagination is required to understand what is happening. What you are supposed to visualize is yourself flying through a narrow corridor with gates strapped from wall to wall across your path. You must stay in the center of the corridor without touching the walls while maneuvering above and below the gates. This concept is tough to grasp from the graphics provided, and, to make matters worse, the documentation tells you that you can pass through the gates. My games kept ending here until I realized that I had to avoid the gates.

If all of this sounds vaguely like **Star Raiders**, you're right. Based on the **Blue Max/Zaxxon** and **Encounter/Battlezone** conversions Synapse is famous for, I fully expected a souped-up, hot-rod version of **Star Raiders**. Synapse, however, has fallen short with **Dimension X**. What is missing is the element of skill that **Star Raiders** requires. **Dimension X** can be completed very successfully by anyone who understands the game and can connect the rules to the screen graphics. I've made it through the game every time at the highest difficulty settings without having to re-fuel, repair or retreat. The Rigillians never even got close to surrounding my capital. Sounds pretty merciful to me.

(Continued on page 90)

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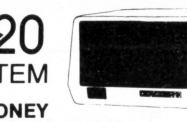

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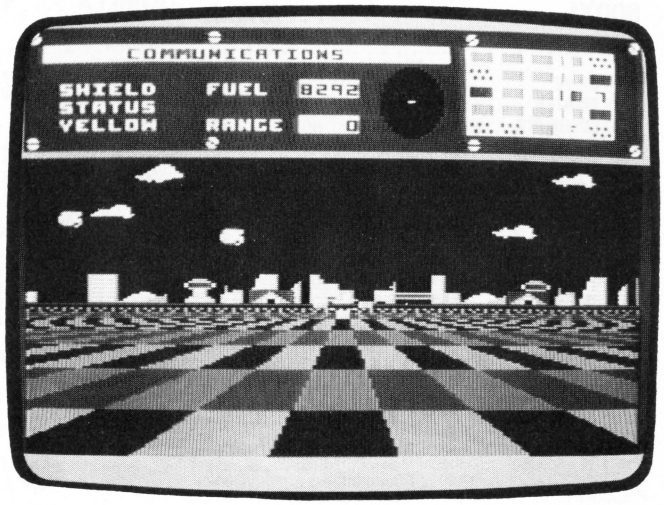
To wrap things up, I'd like to talk about something that disk drive users must be made aware of. When booting **Dimension X**, a foolish protection scheme built into the program causes the game disk to try to write to itself. If it can't complete the task, the program boots fine. However — if you, like several thousand disk drive owners (myself included), have installed a switch to disable the write-protect mechanism, and the switch is engaged, **Dimension X** will write to itself and *reformat the entire disk, wiping out the program*! That's right, you lose everything. There is no mention of this on either the box or the documentation. Synapse must assume that anyone capable of writing to a disk with no write-enable notch is out to copy their software. I spoke with Synapse, and they are currently charging $5 to replace the contents of the disk if they are lost in the above manner. They also stated that they are re-evaluating this protection scheme, and that their marketing people might look into putting a warning on the game. I hope they do something soon, because many people — like myself — will find themselves with an empty disk the first time they try to use it. Boy, was I depressed.

In conclusion, **Dimension X** is disappointing. It doesn't fulfill the promises of the artwork, and isn't nearly as much fun as some of Synapse's other games, such as **The Encounter** (a hot-rod version of **Battlezone**) or **Blue Max** (a souped-up version of **Zaxxon**). Both of these surpass the originals and are a must for the collection of any game enthusiast. Sadly, **Dimension X** doesn't fall into this latter category. □



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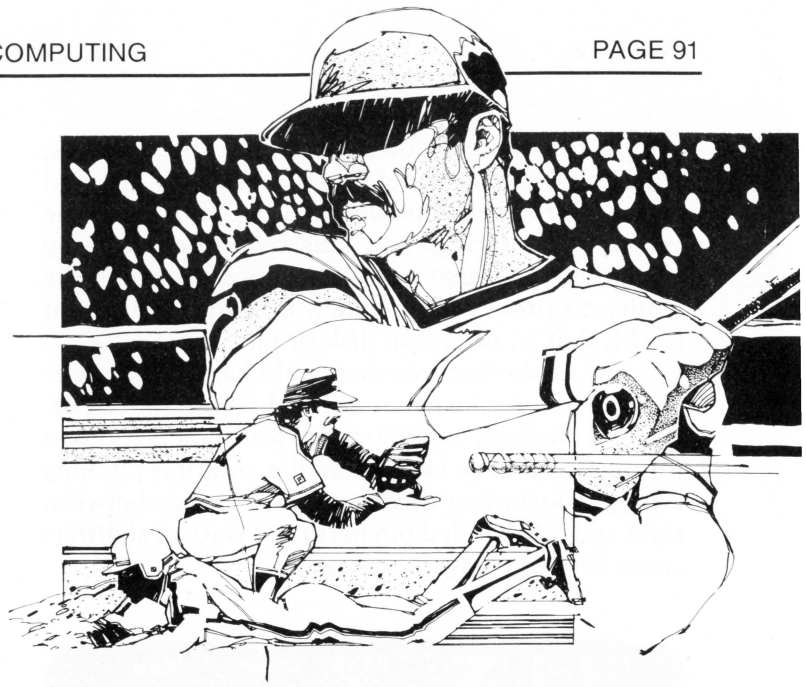

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Gamestar, Inc.
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Santa Barbara, Ca. 93101

by Bob Curtin

Baseball has been called our national game, although the football folks might want to dispute that. Nonetheless, the tarps are rolled back every April for another long season of this national pastime. I, for one, look forward to it every year; I think the game of baseball is as perfect a mixture of action, intensity, tactical variety, subtle strategy and rich tradition as the mind of man has been able to devise. Being an ardent baseball fan, I've been more than a little nettled by the fact that I couldn't get a decent baseball game for my 800, that is until *Gamestar* came along with a little beauty called **Star League Baseball**.

Star League Baseball (**SLB**) is a graphically spectacular, easy to learn baseball game, with enough playing options to satisfy all but the pickiest afficionado. **SLB** can be played between two players, or — if you don't have a human handy and you enjoy pain — you can take on your computer.

There are two starting pitchers available and a short reliever. "Heat" Muldoon has (obviously) a real barnburner of a fast ball, plus a good screwball and slider, but has little stamina and will tire quickly if his fast ball is used too often.

"Curves" Cassidy is the best all around pitcher, with a great curve ball, and a sinker that looks as if it fell off the end of a table. He has good stamina and excellent control. In the long run, Cassidy is the toughest pitcher to bat against when the player using him changes speeds and works the corners effectively.

"Knuckles" Flanagan, the short relief pitcher, as you might guess, has a good knuckler, good control and is almost a necessity when starting with Muldoon.

Once the game starts, everything is controlled through the joysticks. Throwing, catching, running, fielding and batting are all accomplished by using the joystick in conjunction with the fire button. Once you've gotten the mechanics of playing the game down, the fun starts.

As in the real game, pitching is the difference between winning and losing. "Heat's" fast ball is so brutally fast that it has to be anticipated. There's no way you can react to it, except to foul if off. Pitching strategy involves mixing your pitches well and learning your opponent's weak points. The timing is so critical that changing the speed of the pitches is as effective as it is in live baseball. "Going for the corners" involves throwing pitches, such as the sinker and curve ball, which will sometimes miss the strike zone, especially when Heat Muldoon is pitching in later innings. It takes a bit of practice to get to where you can pick the good pitches from the chaff, but the program provides a batting practice mode for just that purpose. (You can get all the fielding practice you want by playing against the computer.)

Pitching is by no means the only thing you've got to worry about. A good defense is not only important, it can save the game if your pitcher loses his "stuff" and starts getting hammered. It takes a lot of practice to consistently catch fly balls, intercept those steaming line drives, and turn the double plays. Developing a hard defense can not only win games for you, but it can have a devastating psychological effect on your opponent (computer excepted).

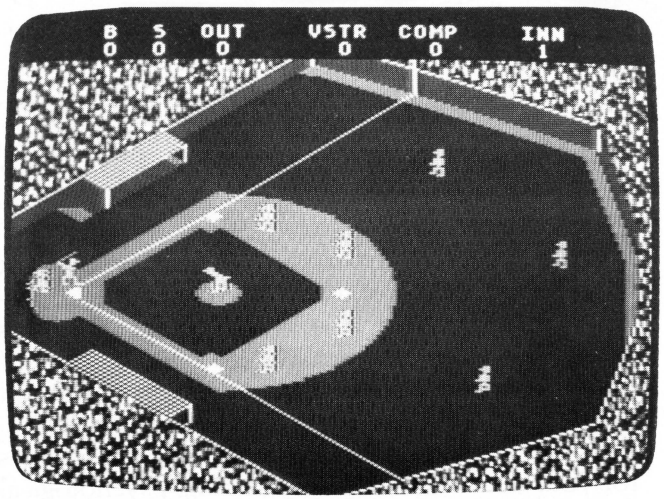
The program is filled with clever little touches. Between innings, there's an electronic scoreboard flashing a trivia question (actually a way of advertising an upcoming *Gamestar* computer game), the attendance and the scores of other games going on in the National and American Leagues. Throughout the game, the sound of the proverbial organist can be heard. All in all, the package is well done, and the playing of the game is fun and easy to grasp. As with **Starbowl Football**, the game has become a must to play when the gang get together for some hot competition, and I think it'll remain a staple on my game shelf for a long time to come.

Now the gripes. First and foremost, the fact that you can only change pitchers during the seventh inning stretch is *very* frustrating. I can see limiting the amount of times you can change your pitcher (one or two times), but limiting the players to one relief pitcher and dictating when the relief must be brought in, is sort of contrary to baseball strategy.

All Atari computers have, for some time, come in two flavors: either 16K or 48K (the new 64K XL computers actually have no more useable RAM than their 48K predecessors). It puzzles me why a game as good as this not only shortcuts on such things as the pitching changes, but shows such singular lack of

imagination in providing optional game features, when they've got another 16K to work with. As good as this game is, it remains on a par with its home videogame offerings and fails to utilize the thing computers have that videogame consoles don't: the ability to process data which is stored outside of RAM, that is, stored on disk or tape.

Some of the features that could have been incorporated are, for instance, left and right-handed batters and pitchers, varying speeds for runners (both in the outfield and on base), pop flies, multiple pitching changes (assuming there was a difference between right and left-handed pitchers) and statistical differences between players and teams.

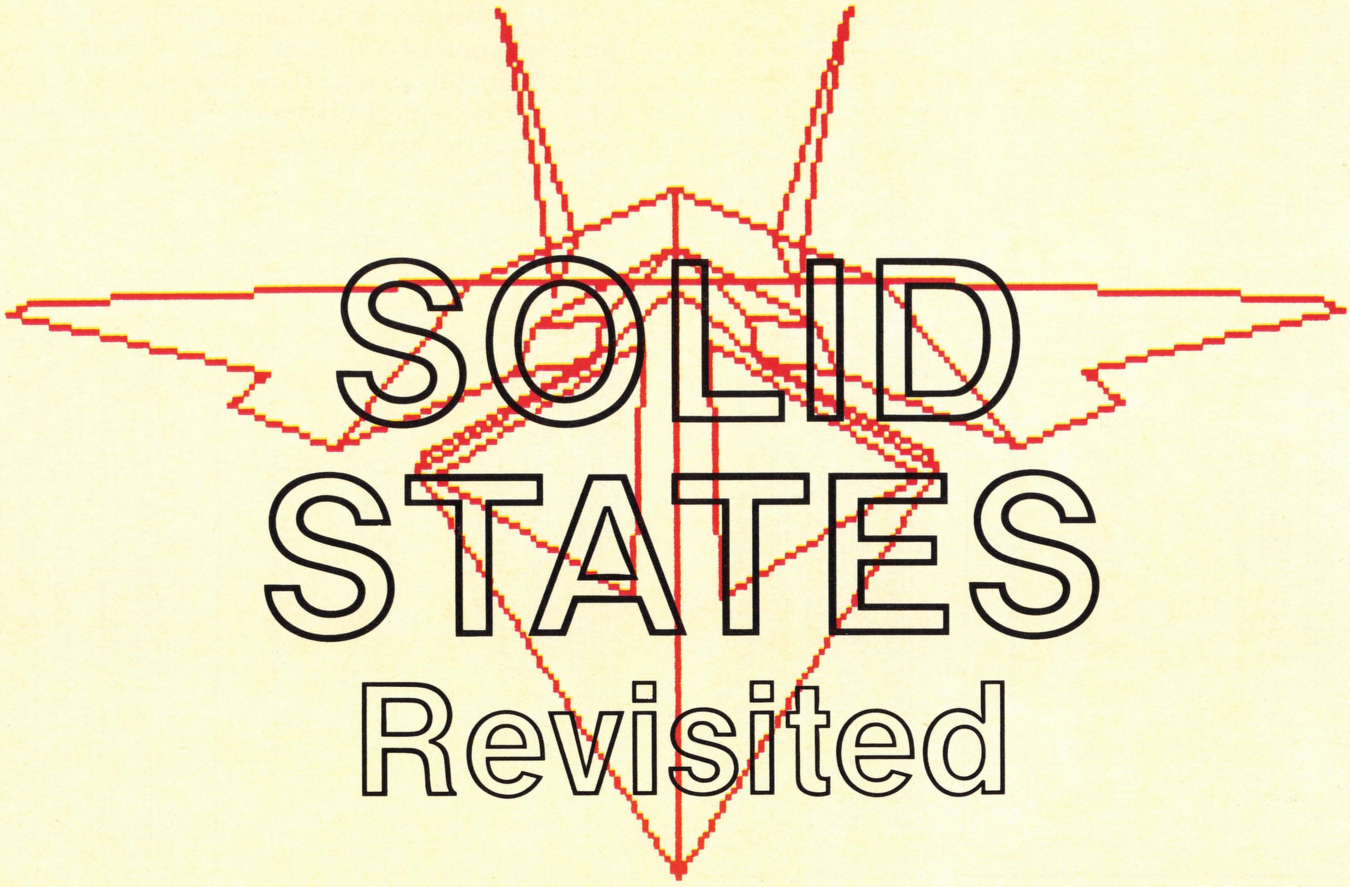


Star League Baseball.

This last option would open up the game to simulate one aspect of baseball strategy sorely lacking in this game: pinch hitting and pinch runners. The last of the ninth, behind by one run, and your star glove comes up to bat. Not real hot with the stick, you decide to replace him with a slug of a base runner and a dolt in the field, but this guy can rap a ball... Just as there's a difference between hitters in **SLB** as the game stands now (i.e., liners and sluggers), individual batters could be similarly loaded for power, average or just plain incompetence with a bat.

Finally, why not a side routine to allow the user to create team statistical files, to be used in the game so that he could play with the statistics of the Yankees... or the Red Sox or the Bohunk Bombers or any team of his choice. Or, if the powers that be had any imagination at all, sell the updated statistical files of all of the major league teams each year, much the same as the boardgamers do with their updated statistical cards.

Anyway, despite the lack of detail, **Star League Baseball** is definitely a must for the sports game enthusiast. It's fun, colorful and habit-forming. □



by ANALOG Readers with Tom Hudson

In issue 16 of **ANALOG**, I presented **Solid States**, a 3-D object plotting system. Readers were asked to send in their 3-D object data and modifications to the original program. Well, we've received a good deal of feedback, and I decided to print some of the more interesting items in lieu of my **Basic Training** column.

For those readers who do not have the **Solid States** program, you can still order issue 16 as a back issue. See the ad elsewhere in this issue.

If you have a copy of **Solid States**, get started typing in the data below!

An "A" for effort.

Paul J. Goldernew, of Pittsburg, PA sent in our first **Solid States** graphic. It is a 3-D representation of the "A" in the **ANALOG** logo. Paul's original data file also contained the entire **ANALOG** logo above the "A," but it was just too big (157 points, 158 lines) for us to print. I did a little editing and cut it down to just the "A" itself, and came out with 100 points and 110 lines. Paul's effort shows how curved lines can be shown with **Solid States**.

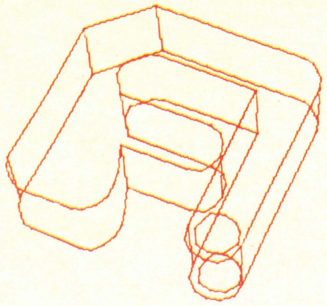
"A" logo data.

```
POINTS:100

POINT 1: 9          -7          6
POINT 2: 9          7           6
POINT 3: 8.75       7.75        6
POINT 4: 8.25       8.25        6
POINT 5: 7.75       8.75        6
POINT 6: 7          9           6
POINT 7: -5         9           6
POINT 8: -9         5           6
POINT 9: -9         -7          6
POINT 10: -8.75     -7.75       6
POINT 11: -8.25     -8.25       6
POINT 12: -7.75     -8.75       6
POINT 13: -7        -9          6
POINT 14: -3        -9          6
POINT 15: -2.25     -8.75       6
POINT 16: -1.5      -8          6
POINT 17: -1        -7          6
POINT 18: -1        -6          6
POINT 19: -1.25     -5          6
POINT 20: -2        -3          6
POINT 21: 3         -3          6
POINT 22: 4         -2.75       6
POINT 23: 4.5       -2          6
POINT 24: 4.75      -1          6
POINT 25: 4.5       0           6
POINT 26: 4         0.75        6
POINT 27: 3         1           6
POINT 28: -4        1           6
POINT 29: -5        2.5         6
POINT 30: -5        3.5         6
POINT 31: -4.5      4           6
POINT 32: -3.75     4.75        6
POINT 33: -3        5           6
POINT 34: 5         5           6
POINT 35: 5         -7          6
POINT 36: 5.25      -8          6
POINT 37: 6         -8.75       6
POINT 38: 7         -9          6
POINT 39: 8         -8.75       6
POINT 40: 8.75      -8          6
POINT 41: 7         -8.25       6
POINT 42: 6         -8          6
POINT 43: 5.5       -7          6
POINT 44: 5.75      -6          6
POINT 45: 6         -5.5        6

LINES:110

LINE 1: 1 TO 2
LINE 2: 2 TO 3
LINE 3: 3 TO 4
LINE 4: 4 TO 5
LINE 5: 5 TO 6
LINE 6: 6 TO 7
LINE 7: 7 TO 8
LINE 8: 8 TO 9
LINE 9: 9 TO 10
LINE 10: 10 TO 11
LINE 11: 11 TO 12
LINE 12: 12 TO 13
LINE 13: 13 TO 14
LINE 14: 14 TO 15
LINE 15: 15 TO 16
LINE 16: 16 TO 17
LINE 17: 17 TO 18
LINE 18: 18 TO 19
LINE 19: 19 TO 20
LINE 20: 20 TO 21
LINE 21: 21 TO 22
LINE 22: 22 TO 23
LINE 23: 23 TO 24
LINE 24: 24 TO 25
LINE 25: 25 TO 26
LINE 26: 26 TO 27
LINE 27: 27 TO 28
LINE 28: 28 TO 29
LINE 29: 29 TO 30
LINE 30: 30 TO 31
LINE 31: 31 TO 32
LINE 32: 32 TO 33
LINE 33: 33 TO 34
LINE 34: 34 TO 35
LINE 35: 35 TO 36
LINE 36: 36 TO 37
LINE 37: 37 TO 38
LINE 38: 38 TO 39
LINE 39: 39 TO 40
LINE 40: 40 TO 1
LINE 41: 41 TO 42
LINE 42: 42 TO 43
LINE 43: 43 TO 44
LINE 44: 44 TO 45
LINE 45: 45 TO 46
```

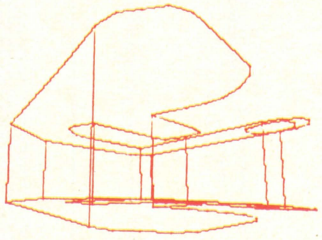
```
POINT 46: 7          -5.25      6
POINT 47: 8          -5.5       6
POINT 48: 8.5        -6         6
POINT 49: 8.75       -7         6
POINT 50: 8          -8         6
POINT 51: 9          -7         0
POINT 52: 9          7          0
POINT 53: 8.75       7.75       0
POINT 54: 8.25       8.25       0
POINT 55: 7.75       8.75       0
POINT 56: 7          9          0
POINT 57: -5         9          0
POINT 58: -9         5          0
POINT 59: -9         -7         0
POINT 60: -8.75      -7.75      0
POINT 61: -8.25      -8.25      0
POINT 62: -7.75      -8.75      0
POINT 63: -7         -9         0
POINT 64: -3         -9         0
POINT 65: -2.25      -8.75      0
POINT 66: -1.5       -8         0
POINT 67: -1         -7         0
POINT 68: -1         -6         0
POINT 69: -1.25      -5         0
POINT 70: -2         -3         0
POINT 71: 3          -3         0
POINT 72: 4          -2.75      0
POINT 73: 4.5        -2         0
POINT 74: 4.75       -1         0
POINT 75: 4.5        0          0
POINT 76: 4          0.75       0
POINT 77: 3          1          0
POINT 78: -4         1          0
POINT 79: -5         2.5        0
POINT 80: -5         3.5        0
POINT 81: -4.5       4          0
POINT 82: -3.75      4.75       0
POINT 83: -3         5          0
POINT 84: 5          5          0
POINT 85: 5          -7         0
POINT 86: 5.25       -8         0
POINT 87: 6          -8.75      0
POINT 88: 7          -9         0
POINT 89: 8          -8.75      0
POINT 90: 8.75       -8         0
POINT 91: 7          -8.25      0
POINT 92: 6          -8         0
POINT 93: 5.5        -7         0
POINT 94: 5.75       -6         0
POINT 95: 6          -5.5       0
POINT 96: 7          -5.25      0
POINT 97: 8          -5.5       0
POINT 98: 8.5        -6         0
POINT 99: 8.75       -7         0
POINT 100: 8         -8         0
```

```
LINE 46: 46 TO 47
LINE 47: 47 TO 48
LINE 48: 48 TO 49
LINE 49: 49 TO 50
LINE 50: 50 TO 41
LINE 51: 51 TO 52
LINE 52: 52 TO 53
LINE 53: 53 TO 54
LINE 54: 54 TO 55
LINE 55: 55 TO 56
LINE 56: 56 TO 57
LINE 57: 57 TO 58
LINE 58: 58 TO 59
LINE 59: 59 TO 60
LINE 60: 60 TO 61
LINE 61: 61 TO 62
LINE 62: 62 TO 63
LINE 63: 63 TO 64
LINE 64: 64 TO 65
LINE 65: 65 TO 66
LINE 66: 66 TO 67
LINE 67: 67 TO 68
LINE 68: 68 TO 69
LINE 69: 69 TO 70
LINE 70: 70 TO 71
LINE 71: 71 TO 72
LINE 72: 72 TO 73
LINE 73: 73 TO 74
LINE 74: 74 TO 75
LINE 75: 75 TO 76
LINE 76: 76 TO 77
LINE 77: 77 TO 78
LINE 78: 78 TO 79
LINE 79: 79 TO 80
LINE 80: 80 TO 81
LINE 81: 81 TO 82
LINE 82: 82 TO 83
LINE 83: 83 TO 84
LINE 84: 84 TO 85
LINE 85: 85 TO 86
LINE 86: 86 TO 87
LINE 87: 87 TO 88
LINE 88: 88 TO 89
LINE 89: 89 TO 90
LINE 90: 90 TO 51
LINE 91: 91 TO 92
LINE 92: 92 TO 93
LINE 93: 93 TO 94
LINE 94: 94 TO 95
LINE 95: 95 TO 96
LINE 96: 96 TO 97
LINE 97: 97 TO 98
LINE 98: 98 TO 99
LINE 99: 99 TO 100
LINE 100: 100 TO 91
LINE 101: 8 TO 58
LINE 102: 9 TO 59
LINE 103: 7 TO 57
LINE 104: 28 TO 78
LINE 105: 20 TO 70
LINE 106: 24 TO 74
LINE 107: 34 TO 84
LINE 108: 35 TO 85
LINE 109: 1 TO 51
LINE 110: 2 TO 52
```

Try the following views:



OBSERVER LOC.	LOOKED AT	ZOOM
30,-50,100	0,6,0	1.5



OBSERVER LOC.	LOOKED AT	ZOOM
-12,-12,1	0,4.5,3	.2

Over "reacting."

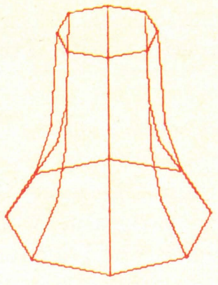
Nick A. Brienza, of Columbia, MD, sent in a 3-D representation of a nuclear reactor cooling tower. Once again, this graphic shows how curved surfaces can be shown with **Solid States**. You'll note that this object was defined using only 32 points, a pretty efficient job.

Tower data.

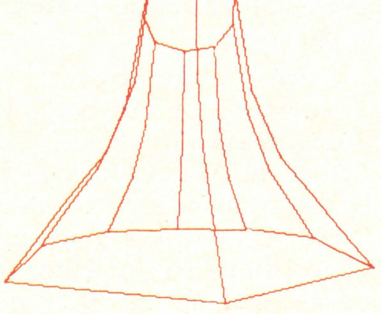
```
POINTS:32

POINT 1: -2          0          8
POINT 2: -2.25       0          4
POINT 3: -2.75       0          2
POINT 4: -4          0          0
POINT 5: -1.3        1.3        8
POINT 6: -1.5        1.5        4
POINT 7: -1.9        1.9        2
POINT 8: -2.7        2.7        0
POINT 9: 0           2          8
POINT 10: 0          2.25       4
POINT 11: 0          2.75       2
POINT 12: 0          4          0
POINT 13: 1.3        1.3        8
POINT 14: 1.5        1.5        4
POINT 15: 1.9        1.9        2
POINT 16: 2.7        2.7        0
POINT 17: 2          0          8
POINT 18: 2.25       0          4
POINT 19: 2.75       0          2
POINT 20: 4          0          0
POINT 21: 1.3        -1.3       8
POINT 22: 1.5        -1.5       4
POINT 23: 1.9        -1.9       2
POINT 24: 2.7        -2.7       0
POINT 25: 0          -2         8
POINT 26: 0          -2.25      4
POINT 27: 0          -2.75      2
POINT 28: 0          -4         0
POINT 29: -1.3       -1.3       8
POINT 30: -1.5       -1.5       4
POINT 31: -1.9       -1.9       2
POINT 32: -2.7       -2.7       0
```

```
LINES:40

LINE 1: 1 TO 2
LINE 2: 2 TO 3
LINE 3: 3 TO 4
LINE 4: 5 TO 6
LINE 5: 6 TO 7
LINE 6: 7 TO 8
LINE 7: 9 TO 10
LINE 8: 10 TO 11
LINE 9: 11 TO 12
LINE 10: 13 TO 14
LINE 11: 14 TO 15
LINE 12: 15 TO 16
LINE 13: 17 TO 18
LINE 14: 18 TO 19
LINE 15: 19 TO 20
LINE 16: 21 TO 22
LINE 17: 22 TO 23
LINE 18: 23 TO 24
LINE 19: 25 TO 26
LINE 20: 26 TO 27
LINE 21: 27 TO 28
LINE 22: 29 TO 30
LINE 23: 30 TO 31
LINE 24: 31 TO 32
LINE 25: 1 TO 5
LINE 26: 5 TO 9
LINE 27: 9 TO 13
LINE 28: 13 TO 17
LINE 29: 17 TO 21
LINE 30: 21 TO 25
LINE 31: 25 TO 29
LINE 32: 29 TO 1
LINE 33: 4 TO 8
LINE 34: 8 TO 12
LINE 35: 12 TO 16
LINE 36: 16 TO 20
LINE 37: 20 TO 24
LINE 38: 24 TO 28
LINE 39: 28 TO 32
LINE 40: 32 TO 4
```

Try the following views:



OBSERVER LOC.	LOOKED AT	ZOOM
45,45,45	0,0,4	2



OBSERVER LOC.	LOOKED AT	ZOOM
5,4,1	0,0,3	.2

Nick also asked if the 3-D views could be animated by showing a series of views in progression. Our next reader came up with a very nice program modification to do just that.

'Round and 'round she goes...

Larry L. Harris, of Poca, WV, has gone beyond the limitations of the original **Solid States** program, and has come up with a program modification that allows for automatic rotation of an object. Because of the memory requirements of this modification, 48k memory is suggested, and even then only fairly small objects can be rotated. Larry writes:

"This modification allows the viewer to rotate about the object in a circle on the X-Y plane with a Z coordinate the user inputs. The radius is determined by the input X and Y corrdinates of the observer's viewpoint. The object appears to rotate on the screen. A two-page flip was added to give instant transition from one frame to the next. You do not see the object develop. It is drawn off-screen, then through a page flip you see the complete object. A machine-language routine is used to clear the GRAPHICS 8+16 screen.

"To add this feature to the existing **Solid States** program, simply add the lines in **Listing 1**. Some are changes to existing lines.

"The program runs like the original until the zoom factor has been entered. Respond Y to "DO YOU WANT TO DO AN X-Y LOOP." Then input the total number of degrees rotation and the number of degrees to increment for each drawing. Expect a screen flicker and some delay while initializing takes place and the first drawing is developed off-screen. Do not turn DMA off if you want to rotate around the object, or you won't see it.

"The program will also operate as originally designed. Just answer N to the above prompt."

Lines 2000-2120 control execution when doing a loop.

Lines 2200-2250 control the page flip

Lines 2300-2360 set up page flip and screen clear routine.

Keep'em coming.

I'd like to thank all the readers who have sent in their 3-D image data. Special thanks goes to Larry L. Harris for his rotation modification. If you've created a 3-D object and haven't sent it in yet, what are you waiting for? Simply send it (on tape, disk or printout) to:

Solid States
c/o ANALOG
P.O. Box 23
Worcester, MA 01603

When we get another good batch of objects, we'll run them in a future issue. □

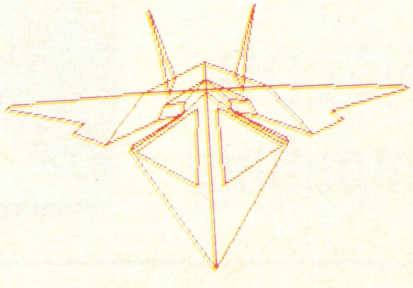
Listing 1.

```
135 ? "* ROTATION:  LARRY HARRIS *"
160 DIM R$(1),A$(5),F$(20),DMA$(1),O$(
1),EG$(2),IN$(1):EG$=CHR$(27):EG$(2)=C
HR$(7)
434 ? :? "DO YOU WANT TO DO AN X-Y LOO
P";:INPUT R$:IF R$<>"Y" THEN 440
436 ? "HOW MANY DEG. TOTAL ROTATION";:
INPUT AN2:AN2=(AN2/360)*6.28
438 ? "HOW MANY DEG. INC. ROTATION";:I
NPUT AN3:AN3=(AN3/360)*6.28:GOSUB 2300
:REM SET UP PAGE FLIP
439 GOTO 2000
850 GOSUB 2200:SETCOLOR 2,0,0:COLOR 1:
TRAP OFF
1035 IF FLAG THEN 2100
1040 IF PEEK(53279)=7 AND STRIG(0)=1 T
HEN 1035
2000 FLAG=1:R=(OX^2+OY^2)^0.5:AN1=ATN(
OY/OX):AN2=AN2+AN1
2100 AN1=AN1+AN3:OX=R*COS(AN1):OY=R*SI
N(AN1)
2120 GOTO 440
2199 REM PAGE FLIP
2200 IF  NOT FLAG THEN GRAPHICS 24:RET
URN
2201 IF AN1>AN2 THEN FLAG=0
2202 XI=XI+1-2*(XI=2):XA=2-(XI=2)
2205 FOR S=40 TO 0 STEP -10:SOUND 0,S,
10,8:NEXT S
2210 POKE DL+4,DLL(XA):POKE DL+5,DLH(X
A)
2220 POKE DL+100,DHL(XA):POKE DL+101,D
HH(XA)
2230 POKE 88,DLL(XI):POKE 89,DLH(XI)
2240 ADS=DLL(XI)+256*DLH(XI):Z=USR(153
6,ADS)
2250 RETURN
2299 REM SET UP DATA FOR PAGE FLIP
2300 TRAP 2500:DIM DLL(2),DLH(2),DHL(2
),DHH(2):X=0:RESTORE 2400
2310 READ DAT:IF DAT=-1 THEN 2330
2320 POKE 1536+X,DAT:X=X+1:GOTO 2310
2330 X=2:GOSUB 2350:X=1:POKE 106,PEEK(
106)-32:GOSUB 2350
2340 RETURN
2350 GRAPHICS 24:DLL(X)=PEEK(88):DLH(X
)=PEEK(89):DL=PEEK(560)+256*PEEK(561):
DHL(X)=PEEK(DL+100)
2360 DHH(X)=PEEK(DL+101):RETURN
2399 REM CLR DATA
2400 DATA 104,24,104,133,4,104,133,3,1
65,4,105,30,133,10,160,0,169,0,145,3,2
00,192,0,208,249,160,0
2410 DATA 230,4,165,4,197,10,208,237,9
6,-1
2500 TRAP OFF:GRAPHICS 24:RETURN
```

•

```
135 DATA 471,818,862,448,491,960,288,9
40,646,226,587,882,488,565,553,9225
2202 DATA 137,386,315,415,598,533,792,
859,512,109,526,736,794,614,58,7384
2399 DATA 298,832,508,534,2172
```

•



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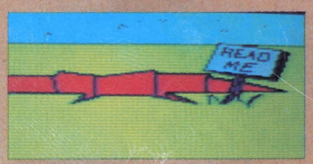

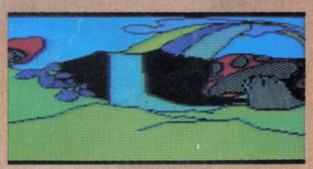

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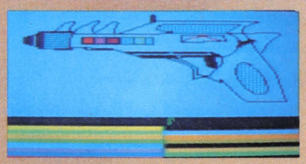

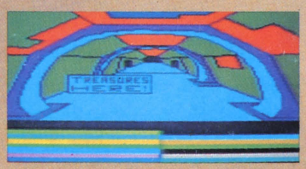

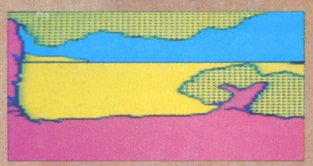

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```
1300 REM PRINT TO PRINTER
1310 REM ---------------
1320 LPRINT :LPRINT "   ";P$;"      ";
D$;"     ";BZ$;"      ";T$
1330 GOTO 1130
1340 CLOSE #1:END
1350 REM ---------------------
1360 REM FORMAT PRINTER OUTPUT
1370 REM --------------------
1380 BZ$="          "
1390 LN=LEN(P$)
1400 IF LN<10 THEN P$(LN+1)=BZ$(1,10-L
N)
1410 LN=LEN(D$)
1420 IF LN<8 THEN D$(LN+1)=BZ$(1,8-LN)
1430 AZ$=STR$(P)
1440 BZ$(4-LEN(AZ$))=AZ$
1450 BZ$=BZ$(1,3)
1460 GOTO 1320
```

•

CHECKSUM DATA

(See p. 30)

```
10 DATA 335,264,977,647,343,485,942,74
,32,322,876,320,609,512,964,7702
170 DATA 489,689,877,871,795,877,52,13
4,77,461,134,324,916,457,479,7632
320 DATA 649,309,648,771,873,523,127,6
77,260,960,419,53,58,172,581,7080
560 DATA 539,903,813,110,746,437,352,7
94,287,902,969,408,403,247,3,7913
710 DATA 645,18,375,934,381,506,668,32
6,75,40,616,393,622,102,783,6484
860 DATA 784,346,666,632,717,39,537,14
1,261,143,812,88,447,369,907,6889
1090 DATA 679,438,659,440,839,405,711,
449,713,488,715,493,710,551,634,8924
1240 DATA 513,636,349,717,885,915,880,
776,715,346,179,444,181,998,22,8556
1400 DATA 846,993,526,230,67,3,721,338
6
```

•

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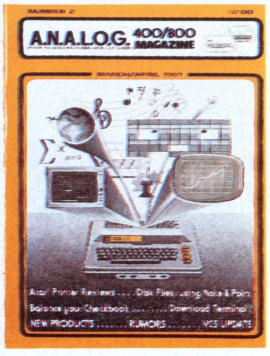

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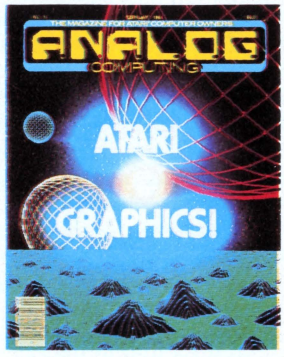

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